CIVIL ENGINEERING

MAY 1938

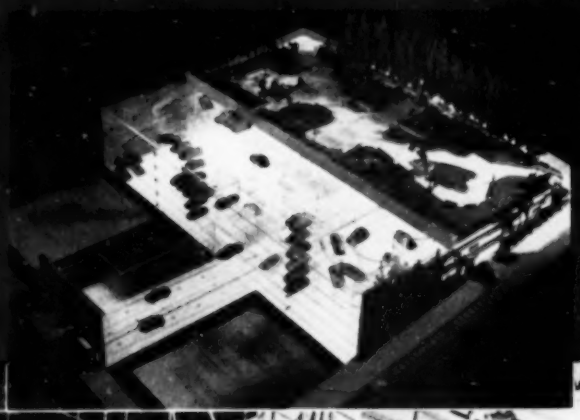
PROCEEDINGS OF ENGINEERING SOCIETIES

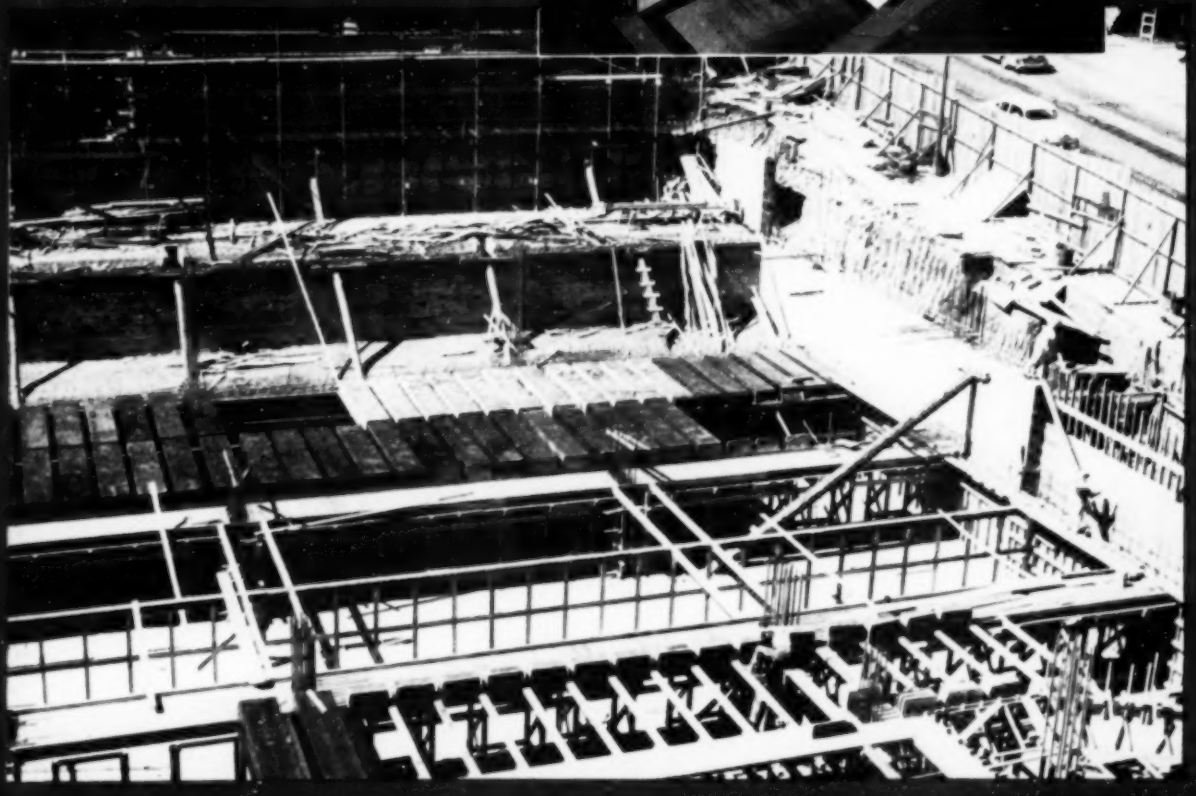
San Francisco dedicates

UNDERGROUND GARAGE

at St. Mary's Square

J. J. GOULD, M. ASCE





PROGRAM • ATLANTIC CITY CONVENTION • JUNE 15-18

Number five of a series . . . . ADVANTAGES OF RAYMOND CONCRETE PILES

saving in construction costs

WHEN YOU SELECT RAYMOND for your foundation projects, you are buying not only superior design and materials—but genuine economy resulting from over half a century of experience in planning . . . supervision . . . performance . . . the expeditious movement of equipment, readily available anywhere in the country and in purchasing materials locally at lowest costs.

RAYMOND MEN AND EQUIPMENT MOVE QUICKLY INTO ACTION ON A RUSH JOB

RAYMOND

CONCRETE PILE CO.

140 CEDAR STREET • NEW YORK 6, N. Y.

Branch Offices in Principal Cities of the United States, Central and South America

RAYMOND'S DOMESTIC SERVICES . . .

SOIL INVESTIGATIONS • FOUNDATION CONSTRUCTION • HARBOR AND WATERFRONT IMPROVEMENTS • PRESTRESSED CONCRETE CONSTRUCTION • CEMENT-MORTAR LINING OF WATER, OIL AND GAS PIPELINES, IN PLACE.

RAYMOND'S SERVICES ABROAD . . .

IN ADDITION TO THE ABOVE, ALL TYPES OF GENERAL CONSTRUCTION.

Thousands of feet of Vitrified Clay Pipe sewers are being installed to serve many aircraft defense workers who live in this Santa Monica, Calif., residential area. The project is being handled by contractors N. J. Tomovich and J. P. Evans.

Wherever There's Expansion ... Clay Pipe is *first choice for SAFE SEWERAGE!*

Ask the officials and engineers of almost any expanding locality, and they will tell you that Vitrified Clay Pipe is the *first-choice sewerage material* to meet the requirements of growing areas.

In one project after another, you find that Clay Pipe is first choice for availability, easy installation, and never-wear-out performance.

When a project is being financed over the years by a bond issue, Clay Pipe is a "must," because it is *guaranteed for 50 years.* Whenever you specify, buy or install sewer lines, insist on the performance-proved material . . . Vitrified Clay Pipe.

NATIONAL CLAY PIPE MANUFACTURERS, INC.

1520 18th St. N.W., Washington 6, D. C.

311 High Long Bldg., 5 E. Long St., Columbus 15, Ohio
703 Ninth & Hill Bldg., Los Angeles 15, Calif.
100 N. LaSalle St., Rm. 2100, Chicago 2, Ill.
206 Connally Bldg., Atlanta 3, Ga.

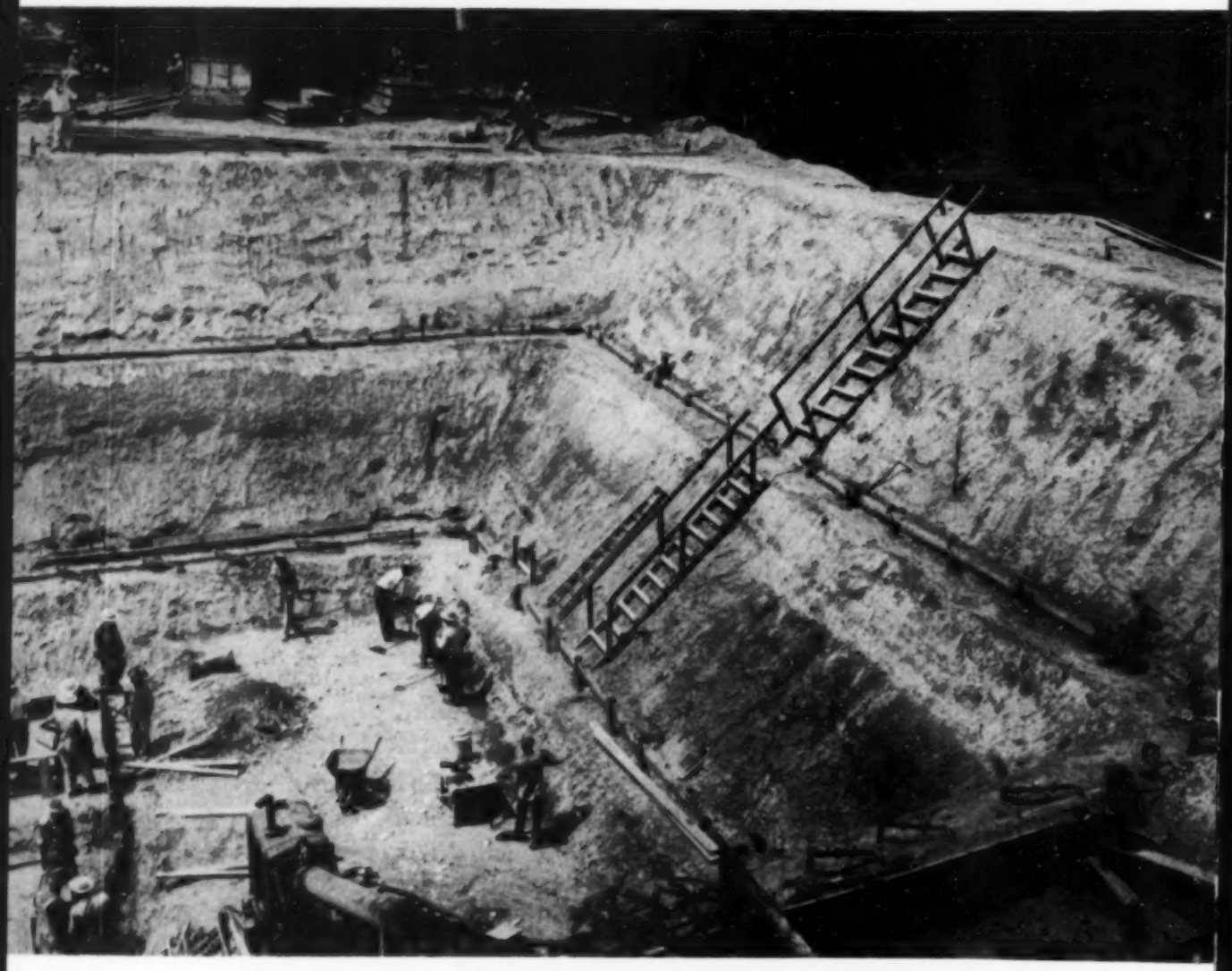
Vitrified CLAY PIPE

C-354-1

CIVIL ENGINEERING, The Magazine of Engineered Construction, May, 1954. Vol. 24, No. 5. Published monthly by the American Society of Civil Engineers. Publication office 20th and Northampton Streets, Easton, Pa. Editorial and advertising departments at the headquarters of the Society, 33 West 39th Street, New York, N. Y. Price 50¢ a copy, $5.00 a year in advance, $4.00 a year to members and to libraries and $2.50 a year to members of Student Chapters. Canadian postage 75¢ and foreign postage $1.50 additional. Entered as second class matter September 23, 1930, at the Post Office, Easton, Pa., under the Act of August 24, 1912, and accepted for mailing at a special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized on July 5, 1918.

Table of Contents is on page 35

DRIED UP AND DUG OUT
.....in just 30 days



Pumping Contractor: American Dewatering Corporation, New York–Houston, Texas

PICTURE 22′ OF WATER IN THIS HOLE! That was the problem facing the contractor in excavating for a pumping station on the Ouachita River in Arkadelphia, Arkansas.

His first step was to install a Moretrench Wellpoint System. Although heavy gravel and marl at grade complicated the pumping operations, the Moretrench System controlled the water perfectly, and dry digging proceeded rapidly. Banks were sloped. Sheeting was unnecessary. *In 30 days, the excavation was down to grade. Time and money were saved!*

Constructive help on how to handle your wet job is as near as your phone. Call any one of our offices for a prompt answer to your problem.

MORETRENCH CORPORATION

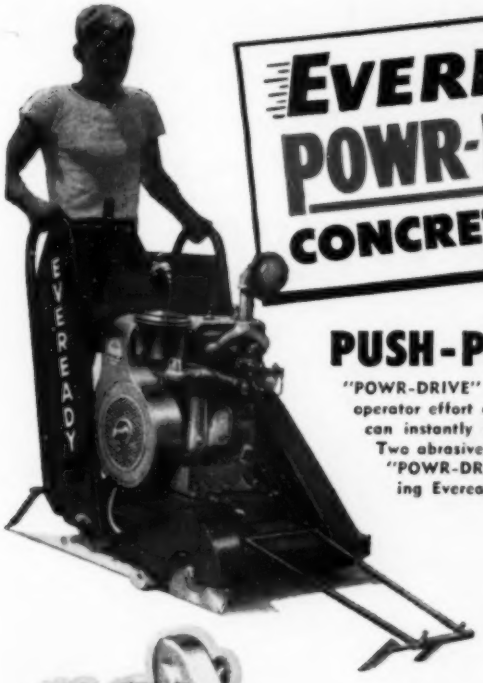
90 West St. New York 6 | 4900 S. Austin Ave. Chicago 38, Illinois | 7701 Interbay Blvd. Tampa 9, Florida | 315 W. 25th St. Houston 8, Texas | Rockaway New Jersey

Western Representative: Andrews Machinery of Washington, Inc., Seattle 4, Washington

Canadian Representative: Geo. W. CROTHERS Limited, Toronto, Ontario

EVEREADY POWR-DRIVE CONCRETE SAW

Ask Your EVEREADY Dealer for the Most Complete Line of Masonry and Concrete Cutting Equipment

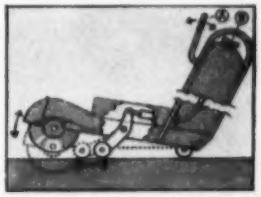


We've taken the PUSH-PULL Out of Concrete Sawing

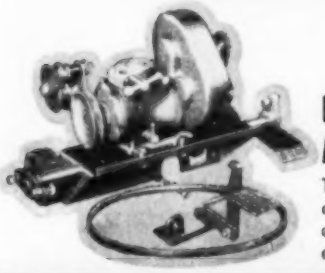
"POWR-DRIVE" smoothly drives saw forward at your controlled speed . . . saves operator effort and increases cutting footage per day. With "POWR-DRIVE" you can instantly regulate the cutting speed to your various cutting requirements. Two abrasive-coated wheels act as a friction drive in contact with both rear saw wheels. "POWR-DRIVE" is engaged or disengaged by a convenient foot lever control. See the amazing Eveready "POWR-DRIVE" Concrete Saw at your local Eveready Dealer.

PATENTED EVEREADY FEATURES

Shown at the right are three exclusive features that make EVEREADY the fastest, most efficient concrete and asphalt cutting saw. Other features are: Dashboard controls for greater ease in operation and maneuvering; blade depth control that permits sawing to a specified depth.



Two easy strokes of Hydra-Eze Handle (A) and hydraulic power lifts blade fast —straight out of cut. Quarter turn of Hydra-Eze Blade Release Lever (B) and hydraulic power feeds blade gently, smoothly into material.



BUY COMPLETE OR ADD THE NEW EVEREADY POWR-DRIVE KIT LATER

The "POWR-DRIVE" Kit comes completely assembled . . . only four holes—four bolts are needed to install the kit on any Eveready Concrete Saw. "POWR-DRIVE" Kits are sold only by authorized Eveready Dealers.

On rough or uneven surfaces—the blade on an EVEREADY Concrete Saw always cuts in a perfect, true, vertical plane. TRI-MATIC BLADE ALIGNMENT prevents binding, twisting, or tilting of the blade as the saw moves over uneven or broken surfaces.

"POWR-DRIVE" cuts MORE Concrete Every Hour . . . Cuts Costs on Every Job! and EVEREADY'S "PROVEN QUALITY" is Your Guarantee for "PROVEN RESULTS"!

EVEREADY Concrete Blades

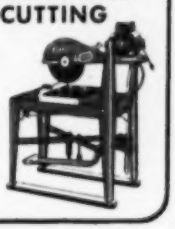
EVEREADY RED-I-CUT DIAMOND BLADES

For faster cutting — PLUS maximum blade life — regardless of the type Concrete or Asphalt cut. Red-I-Cut Blades fit EVERY make and model saw.

EVEREADY TUFFIE CONCRETE BLADES

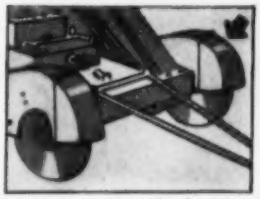
Cut Green Concrete at ONE-THIRD the cost! The NEW "TUFFIE" Abrasive Blade, reinforced with steel wire-mesh, cuts new highway slab—ALL "Green Concrete" slab—at unbelievable savings in labor and blade cost. Your dealer has it NOW!

EVEREADY BRIKSAW FOR MASONRY CUTTING



FREE BOOK

FREE BOOK on Masonry cutting . . . requested by more than 18,000 . . . will be sent without obligation . . . or ask your dealer.



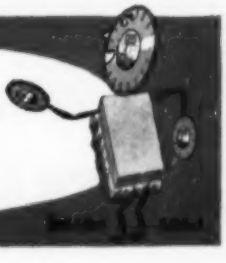
Place blade on either side of saw to cut in corners and confined areas. Blade guard, water hose, and front guide wheel marker assembly are all interchangeable.

EVEREADY DEALERS...

in Most Principal Cities in the United States and Canada

Write for the Name of Your Nearest Dealer.

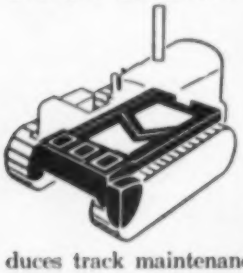
EVEREADY BRIKSAW CO. ● 1509 S. MICHIGAN BLVD. CHICAGO 5L, ILL.



HERE'S TRACTOR VALUE YOU CAN MEASURE

IN yards PER DAY... IN years OF SERVICE

The Allis-Chalmers HD-9 Tractor offers performance reliability and ease of servicing that pays off in year-after-year efficiency. Here's what we mean:



BUILT TO STAND THE GAFF OF DAILY USE FOR YEARS...

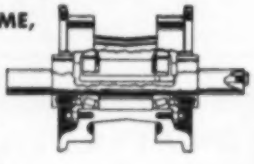
One-piece, welded main frame forms a continuous, strong backbone that means longer life for each tractor.

Oil-enclosed track release mechanism keeps adjustment at required setting and reduces track maintenance and breakage.

Smooth, efficient power train gives extra life, greater ability to absorb the punishment of tough jobs for every gear, shaft and bearing in the tractor.

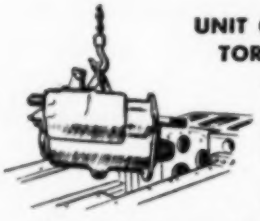
A-type truck frames permit free track oscillation and eliminate twists and strains caused by rough terrain.

EASIER LUBRICATION SAVES TIME, HELPS PROTECT EQUIPMENT



Lubrication period of 1,000 hours for final drives, truck wheels, idlers and support rollers saves both grease and time. Spring-loaded, Positive Seals keep grease in, keep dust and water out.

Fewer, more accessible lubrication points make short work of a chore. No lube points at all under tractor.



UNIT CONSTRUCTION PUTS TRACTORS BACK TO WORK SOONER

Transmission can be removed as a unit without removing clutch, final drive or bevel gear.

Engine can be removed without disassembling clutch.

Truck frame can be dismantled without removing final drive, sprocket or equalizer spring.

Clutch assembly can be removed without disturbing engine or transmission.

Final drive gear and intermediate gear can be removed without disturbing steering clutch.

Each steering clutch can be removed independently without disturbing final drive or bevel gear.

• • •

Let your distributor tell you more about the rugged construction, ease of servicing and outstanding performance ability of the Allis-Chalmers HD-9 Tractor. It's a story that adds up to value you can measure in yards per day and in years of service.

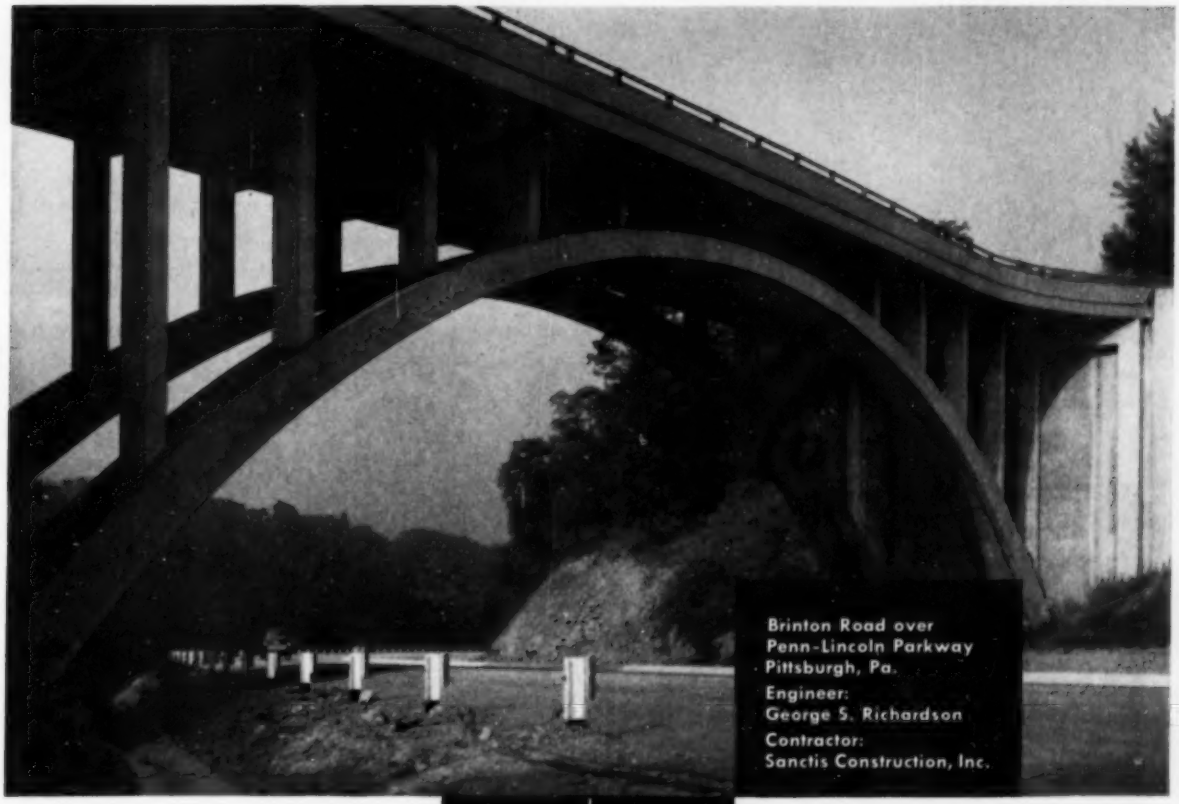
ALLIS-CHALMERS
TRACTOR DIVISION — MILWAUKEE 1, U. S. A.

Bridge appropriation dollars go further when you design for reinforced concrete. And, this flexible medium permits imaginative and beautiful designs which cannot be achieved with any other type of construction.

Structures built of reinforced concrete are durable, too . . . resistant to wind, shock, vibration, and quakes. Furthermore, the necessary construction materials and labor are readily available from local sources.

But find out for yourself. On your next bridge or overpass, design for *beauty plus economy* . . . design for reinforced concrete.

for BEAUTY plus ECONOMY
build with REINFORCED CONCRETE



Brinton Road over
Penn-Lincoln Parkway
Pittsburgh, Pa.
Engineer:
George S. Richardson
Contractor:
Sanctis Construction, Inc.

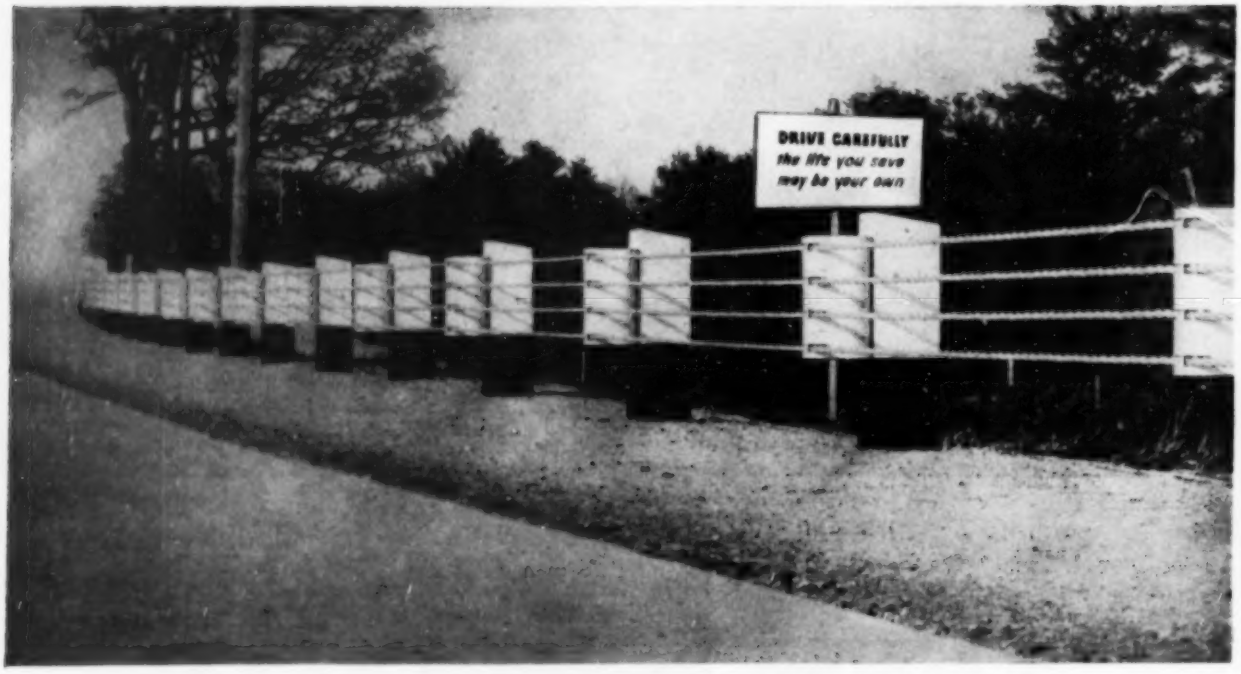
Compare...

YOU'LL SAVE WITH REINFORCED CONCRETE

38 South Dearborn Street • Chicago 3, Illinois

CONCRETE REINFORCING STEEL INSTITUTE

Proved Protection with Amergard



EASY INSTALLATION and maintenance make Amergard a low-cost highway guard. No skilled labor and few tools are required. Properly installed, Amergard stays attractive, resists corrosion and weather.

at High Speeds
Highway Cable Guard

WE took no chances when we designed Amergard Highway Cable Guard. We made actual tests—sent automobiles hurtling into experimental guards of all types—and only then got down to the important business of designing a highway guard.

Results of over 140 of these impact tests prove that Amergard, which is made of strong *flexible* steel cables, gives greater protection to automobiles and passengers than any other type of highway guard.

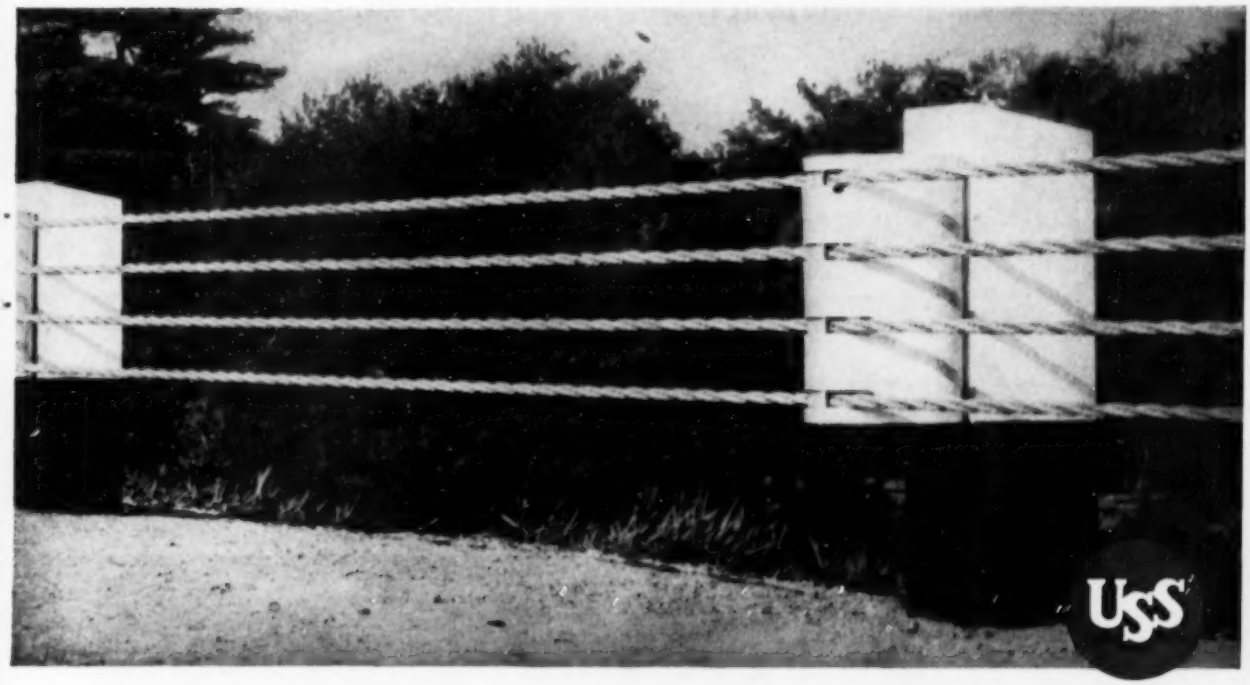
Amergard gives *double-action* cushioning. First you have the inherent flexibility of the cable acting to cushion the shock of a collision, and, second, you have special spring-steel offset brackets that add extra shock absorption.

Amergard's special features make it possible to design the safety of your highways to suit a given rate of speed. Three-cable, 75,000-lb. Amergard provides adequate protection for speeds of 55 mph or less. Four-cable, 100,000-lb. Amergard provides adequate protection up to about 75 mph. Remember, these are the speeds at the point of impact with the cable. It's safe to assume that a car would have to be going *much faster* on the roadway to achieve these speeds at impact.

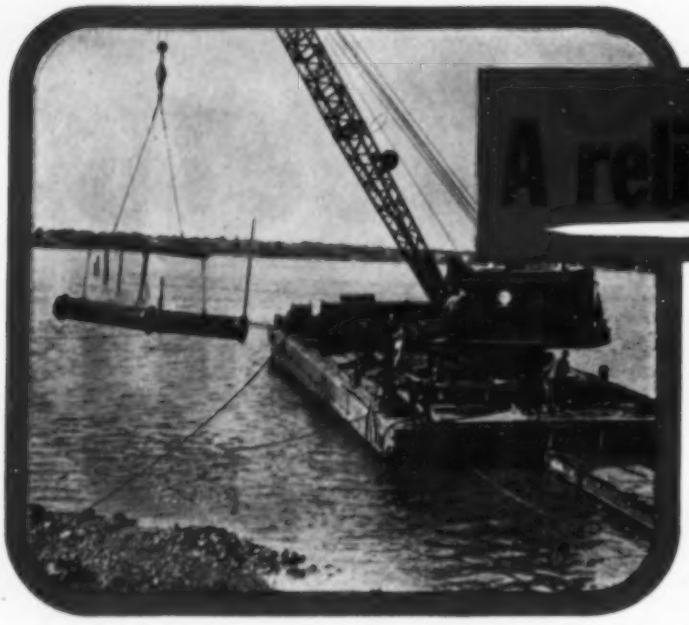
Our engineers will be glad to help you plan the safety guard on your next highway. They can give you expert advice on both design and installation. Write for complete information.

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL CORPORATION, GENERAL OFFICES: CLEVELAND, OHIO

COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK



UNITED STATES STEEL



A reliable material

Installing 30-inch cast iron mechanical joint pipe for outfall sewer at East Providence, R. I

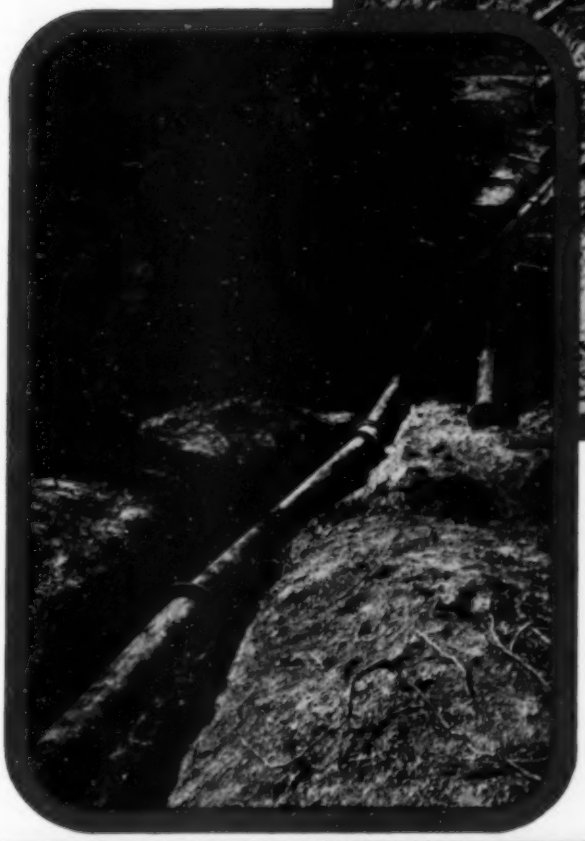
Where installations are planned for long-term service to assure low cost per service year, engineers rely on cast iron pipe as a dependable and adaptable material. Consequently, it is specified for a wide variety of applications, both utility and industrial, including water supply, gas, sewerage, fire protection, power plants, oil refineries, process industries and many forms of special construction. Long life and low maintenance cost are *proved* results of the high beam-strength, compressive-strength, shock-strength and effective resistance to corrosion of cast iron pipe. For information write: Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 122 So. Michigan Ave., Chicago 3, Ill.

(above)
Laying 16-inch cast iron pipe alongside railroad tracks at Ft. Lauderdale, Florida.

(at right)
Cast iron pipe being installed for large process industry plant in Chicago.

CAST IRON PIPE

for permanent construction

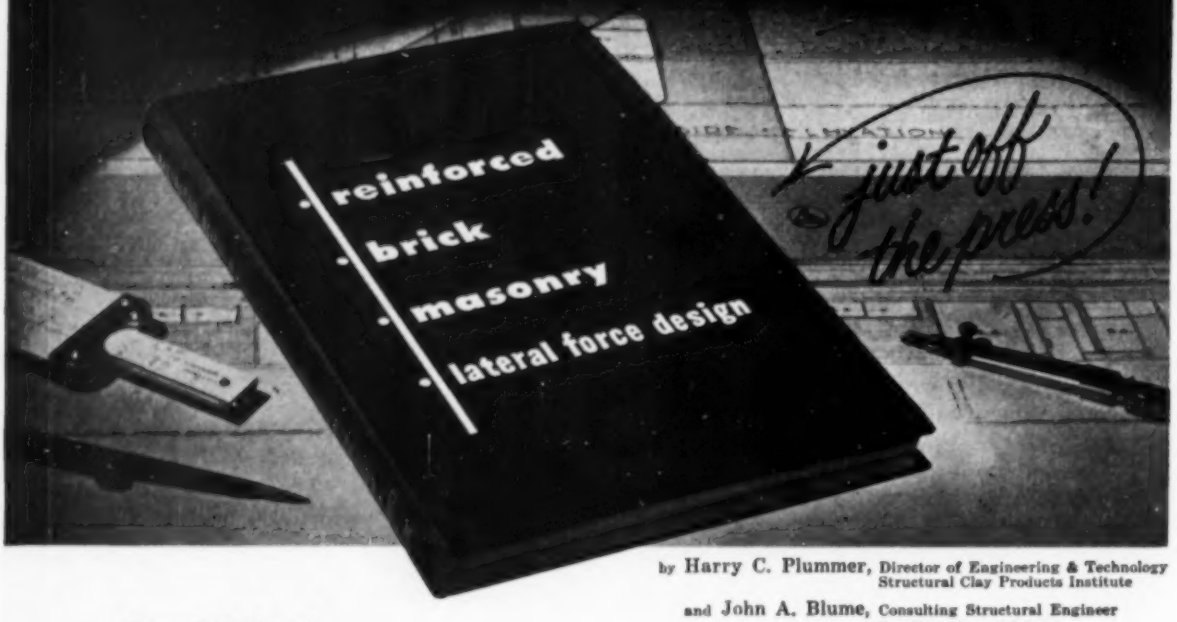


(above)
Installing 30-inch cast iron pipe for sewage treatment plant at Panama City, Florida.

(at left)
Eight-inch mechanical joint cast iron pipe installed under difficult conditions to carry coal mine water at Sumiton, Ala.

SERVES FOR CENTURIES . . .

New lateral force design reference



by Harry C. Plummer, Director of Engineering & Technology
Structural Clay Products Institute

and John A. Blume, Consulting Structural Engineer
San Francisco, California

Over 150 details, tables and photographs

only $4.95

timely... authoritative... complete...

This new textbook is written to meet the growing demand among engineers and architects for concise, authoritative information about structural systems which will resist tornadoes, earthquakes or bomb blast. (A recent survey shows that lateral force considerations are playing a more important role in the design of many structures.)

The book tells how to use Reinforced Brick Masonry (RBM) in lateral force design—thereby retaining the advantages of brick's wide color range, pleasing textural effects, permanence and freedom from maintenance. It contains scores of details of RBM construction in a wide variety of structures, comparative cost figures, data on the performance of both reinforced and unreinforced masonry, recommended design and construction procedures and a review of currently accepted design criteria.

SEND COUPON TODAY

Structural Clay Products Institute, Dept. CE-5
1520 18th Street, N. W.
Washington 6, D. C.

Please send me_____copies of "Reinforced Brick Masonry and Lateral Force Design" at $4.95 per copy. I enclose my check for $_____

Name_____

Firm_____

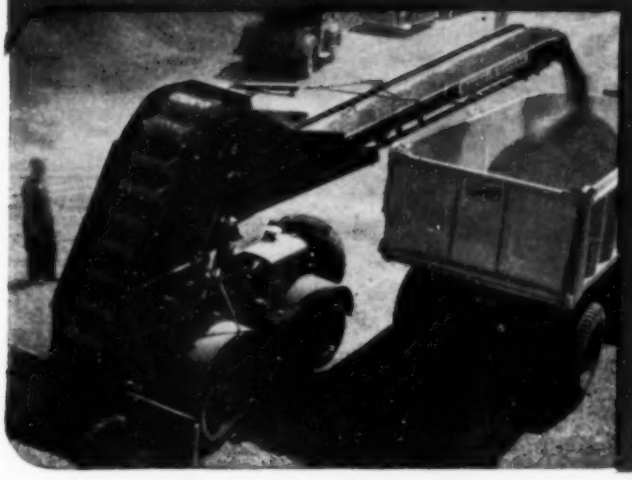
Address_____

City_____ Zone_____ State_____

SCPI

STRUCTURAL CLAY PRODUCTS INSTITUTE
1520 18th Street, N. W., Washington 6, D. C.

FASTEST, EASIEST WAY TO LOAD MATERIAL FROM STOCK PILE INTO TRUCKS



BARBER-GREENE BUCKET LOADERS

No other machine, no other method can equal the speed and efficiency of Barber-Greene Bucket Loaders in loading sand, gravel, and other similar bulk materials from stock piles and storage areas into trucks. At rates up to 3 cubic yards per minute, these loaders dig, lift and convey bulk material in one continuous high capacity flow, virtually eliminating truck waiting and driver waiting time. Simple to operate, easy to understand. The truck driver can operate the loader to load his own truck. Backed by over 1,000,000,000 yards of material handled by Barber-Greene Loaders, they represent the ultimate in low-cost loading efficiency.

A TYPE THAT WILL DO YOUR JOB BEST

MODEL 543

This self-propelled loader is mounted on a tractor-type chassis and pneumatic tires for traveling from job to job at rates up to 15 m.p.h. Equipped with a hydraulic swivel conveyor, it has the reach to load highest trucks, long trucks and trailers, and trim the load to full capacity every time. Capacity—3 cubic yards per minute. Easily converted for loading coal or snow.

Send for catalogs!

Complete and detailed information on the Model 543 and 82A is contained in individual catalogs available at your request. Ask your Barber-Greene Distributor or write directly to the address below.

MODEL 82A

This crawler-mounted, 3 cubic-yard per-minute Bucket Loader has the stability so often necessary in typical truck loading operations—in pits, on soft or rocky ground, etc. Built for heavy, continuous operations, it is economical enough to justify itself in intermittent service. Complete accessories are available, including single and double deck vibrating screens for loading, screening and scalping simultaneously.

Barber-Greene

Aurora, Illinois, U. S. A.

CATERPILLAR

When construction men agree

Rarely is there such complete agreement on one make of equipment among owners, superintendents and operators as reported on these pages. Caterpillar* track-type and wheel-type Tractors, Motor Graders, Diesel Engines, Electric Sets, Scrapers and Bulldozers all share the praise of men working on the Kansas Citys Flood Control project.

CAT* NO. 12 MOTOR GRADER does quality work in tough, sticky soil on the new levee in Kansas City, Kans. Explains M. C. Green, general superintendent of Storms & Frew Construction Co.: *"We favor Cat machines because they take more abuse than other makes but still are easier to operate."*

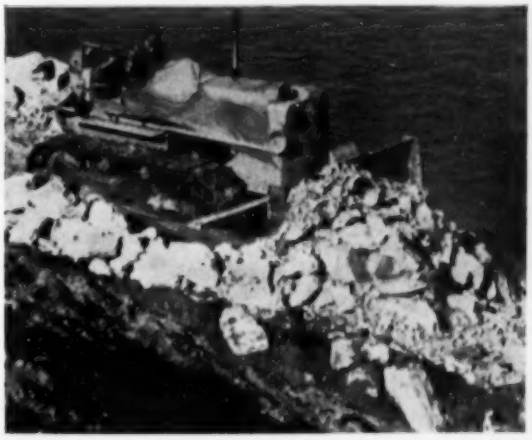
A D13000 DRIVES TOWBOAT *JOHN THOMAS*, owned by Massman Construction Co. The boat moves and holds in place barges with 190 tons of rock to fill tow trench in the Kaw at Turner, Kans. The operator, Alan Anderson, declared: *"The D13000 has all the power I need and it's not a noisy engine. I have to live with it, so this means a lot to me."*

POWERFUL CAT D337 DIESEL powers the Joy Compressor for drilling blast holes in a new quarry to obtain rock for two Kansas City levees. Rock formations include Cement City Ledge 8′ deep, Raytown Limestone 8′ deep, and Argentine Limestone 30′ deep. Expected production: 3000 tons daily. Says J. W. Petett, superintendent for George Bennett Construction Co.: *"This compressor gives us all the pressure we need to operate two drills without running itself to death."*

TIGHT TURNS IN SANDY SOIL were required of this D8 with No. 80 Scraper, owned by Miller Brothers Construction Co. Despite these tough conditions, the Caterpillar unit is making 45 to 50 round trips daily with heaping loads on a half-mile haul at the Kaw's mouth. Little wonder that owner W. F. Miller says: *"In the 14 years we've been operating, we have found these tractors to be our most durable and rugged machines."*

DRAGLINE DRIVEN BY CAT D13000 works 16 hours a day on the project. Owned by Massman Construction, this Manitowoc 1½ yd. dragline will dig a tow trench, fill it with rock, and dress the slope on the levee with riprap. Frank W. Pitz, superintendent, said: *"I think we have only one power shovel without a Cat Diesel in it. Sounds like we like them, doesn't it?"*

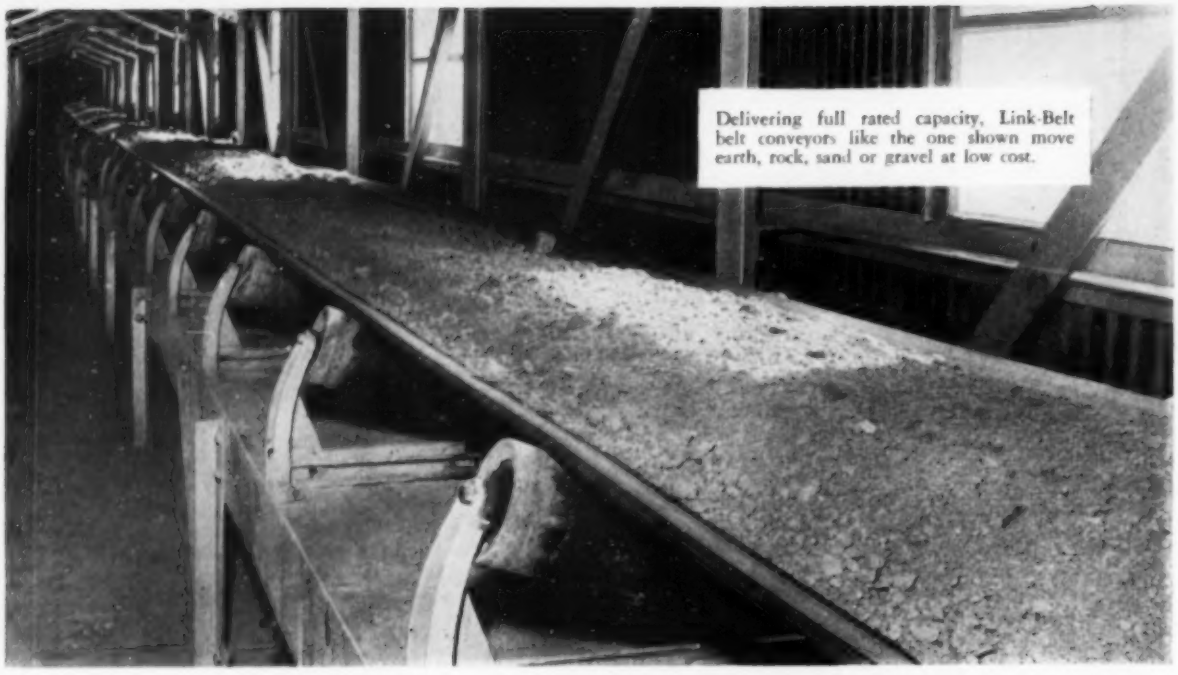
SAFETY ON THE D7 is uppermost in the mind of Johnnie Stone, operating the tractor for Bales & Kite. Says Johnnie: *"I wouldn't work on a steep bank like the ones around here with any other make of tractor."* Equipped with a No. 7S Bulldozer, the D7 is 'dozing the top of the riprap as it is dumped at the mouth of the Kaw River.



A CATERPILLAR TEAM PRODUCES for Bales & Kite at the mouth of the Kaw. The speedy DW10 with a No. 13 Scraper dumps sand where a dragline powered by a D13000 picks it up and redistributes it. It is used on the levee face to form a foundation for rock. Production: 1080 cu. yds. daily. Says co-owner M. B. Kite: *"The best all-around machines are Cat machines. They have longer life, less down time and my men like to operate them better."*

CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS

*Both Cat and Caterpillar are registered trademarks—®



Delivering full rated capacity, Link-Belt belt conveyors like the one shown move earth, rock, sand or gravel at low cost.

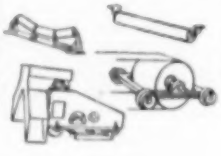
SURE ROAD TO LOWER HANDLING COSTS

... carry the load via Link-Belt belt conveyors

LINK-BELT offers you the "total engineering" so necessary for top efficiency

DESIGNED FOR OVERALL EFFICIENCY—Because of its unrivaled experience, Link-Belt can do a better job of gathering and analyzing all data. Proposals reflect this understanding of the most practical way to fit individual conveyors into your overall system requirements for best results.

BUILT FOR LONG-LIFE PERFORMANCE—Link-Belt manufactures all components and related feeders and conveyors. You are assured of the right equipment because of this breadth of line. And Link-Belt will supply the highest grade belts engineered to the specific job.



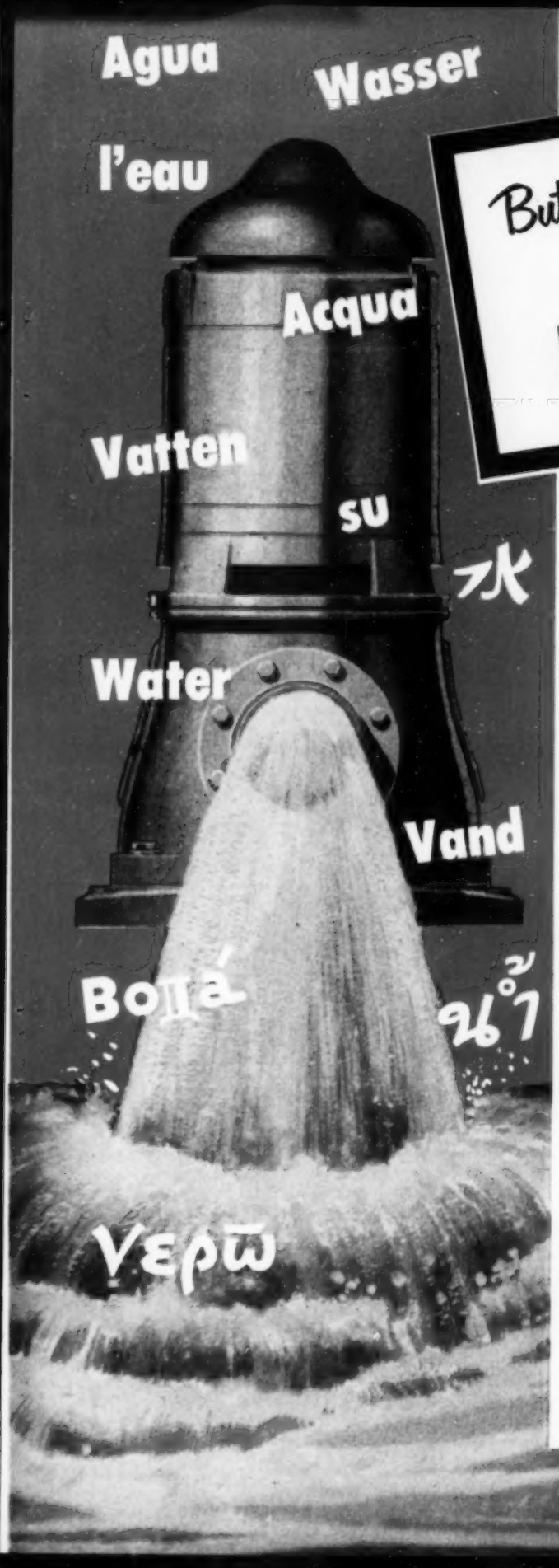
DELIVERS FULL RATED CAPACITY—Link-Belt follows through on every detail of the job, including electrical controls and even wiring and foundations. What's more, Link-Belt will furnish experienced erection superintendents, staffs and skilled crews at the customer's request.

ASSURES SATISFACTORY PERFORMANCE—When you rely on Link-Belt as a single source for your complete system, we accept responsibility for placing it in full operating readiness. We will also supervise modernization of existing systems. For all the facts call your nearby Link-Belt sales representative.

LINK-BELT

BELT CONVEYOR EQUIPMENT

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World. 13,486



But the INTERNATIONAL word for water is LAYNE

Conquering all barriers of space, language and time, Layne service and Layne equipment is known and respected wherever man has need for water. And that need is universal.

Long years ago, a man named Layne with a one man muscle power rig drilled a hole in arid land—then known as Dakota Territory—and the first Layne well went into service. Through the years between, an idea has grown into a service that knows no boundaries and Layne & Bowler, Inc. are today the world's largest developers of ground water resources.

The "know how" that has accumulated in that nearly three quarters of a century is today available to industry, agriculture and municipality. Focused on specific problems through trained engineers and technicians, it is a unique service that includes exploration . . . drilling . . . modernization . . . maintenance and installation of Layne equipment.

From the largest industrial and municipal projects to the small farmer concerned with an irrigation system, that knowledge is available without cost or obligation.

On any problem that relates to water it is wise to first consult Layne & Bowler, Inc. either directly or through an associated Layne company.

Layne

LAYNE & BOWLER, INC.

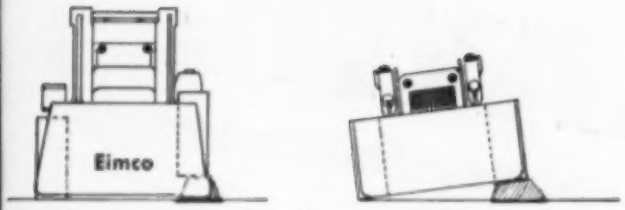
General Offices, Memphis 8, Tenn.

Layne Associate Companies Throughout the World

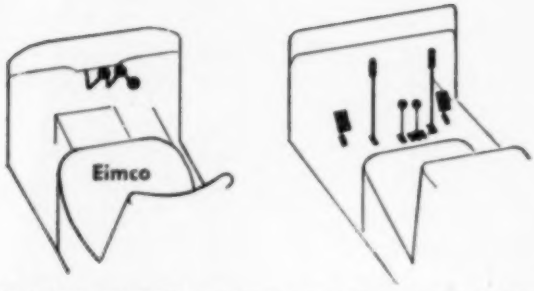
An informative booklet "Bulletin No. 100" will be sent free upon request.

EIMCO

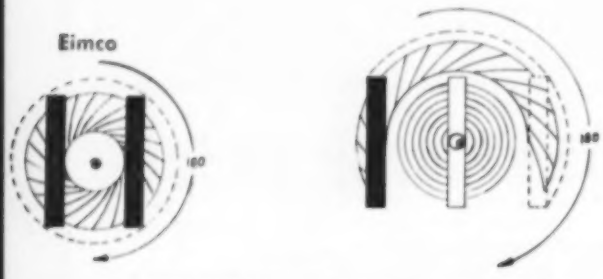
WORLD'S FINEST TRACTOR EXCAVATOR



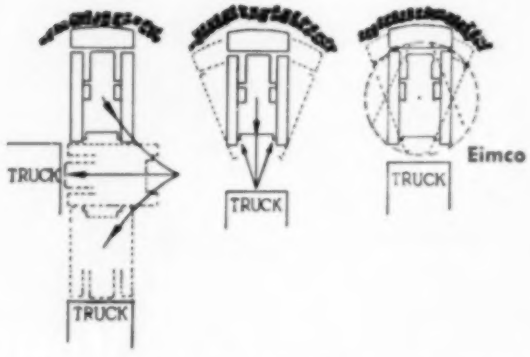
OSCILLATION — with loader attachment — exclusive on Eimco 105, this feature permits better loading on uneven floors in pits or stripping operations.



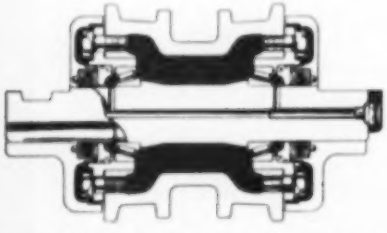
EASY SIMPLE CONTROLS — Eimco's easy finger tip controls give better maneuverability with less effort. Change speeds without stopping — instant reverse.



INDEPENDENT TRACK OPERATION — In a turn one track runs forward, the other reverse, cutting turning radius to a minimum. Eliminates excessive wear on track, rollers, idlers and track frame. On most machines one side is locked and skidded for a sharp turn.



MANEUVERABILITY — Faster loading into haulage units because of Eimco's overhead loading action and independently controlled tracks. Note trucks can be kept closer, cutting haulage time.



THE EIMCO 105 TRACK ROLLER — A one piece cast alloy steel roller with bearing cages and husky shaft on Timken roller bearings completely sealed against dirt and moisture. Careful heat treatment prolongs life and maximum grease capacity assures lubrication.

BETTER VISIBILITY — The operater sits up front where he can see. Loading, bulldozing or pushing are more efficient, eliminate guesswork.

Every feature of the Eimco 105 is designed for maximum customer service with minimum maintenance. One of these features is the full oscillating track **EVEN WITH THE LOADER ATTACHMENT.** This is an exclusive feature on the Eimco 105 since standard practice in the construction field is to tie the tracks rigidly when a loader is mounted on any tractor unit.

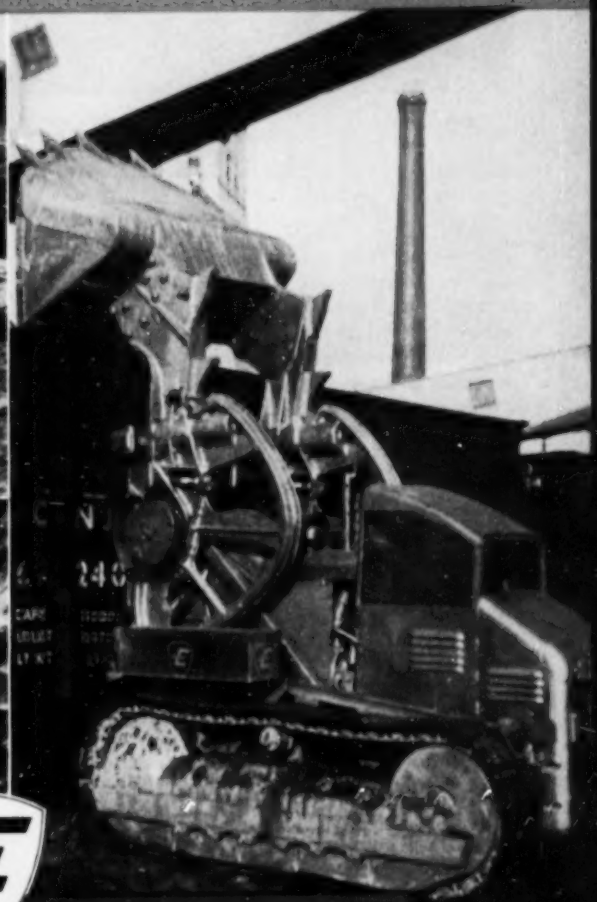
The full oscillating feature prevents excessive frame twist, wear on tracks, rollers, and idlers. Traveling on uneven ground the heavy equalizer bar supports the front end of the tractor and rides freely in its universal type socket in each track roller frame so that either track is free to move up or down without tilting the engine or frame.

This feature provides maximum ground contact under all conditions and maximum drive which is essential in good digging and loading.

Write for information to The Eimco Corporation, P. O. Box 300, Salt Lake City, Utah.

WITH COST SAVING ADVANTAGES

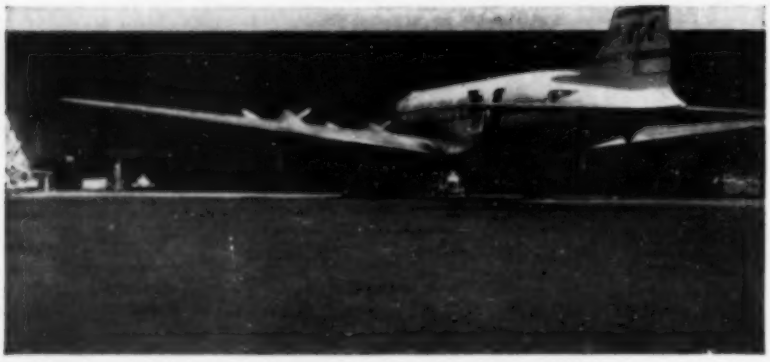
Above left: Eimco 105 digs in stock pile of chunky limestone. Above right: Two speed bucket mechanism loads light trucks easily and fills big trucks full. Below left: Loading rock from pit. Bottom: Clearing slide area after heavy rain. Below right: High discharge loads into high railroad cars.



EIMCO

THE EIMCO CORPORATION

Aircraft fueling area sealed for less than 6¢ per sq. ft.



...with COLFIX® JET SEAL

10,000 sq. yds. of Hanger Apron and Fueling Area for Pan American Airways Corporation at the Seattle-Tacoma International Airport were recently sealed with Colfix Jet Seal—for protection against wear, weather and solvent action of fuels.

This job was let at a contract price of under 6¢ per sq. ft. Work began with cleaning of the area, followed by a rapid squeegee and broom application of diluted Colfix Primer. This method assures good bond even to a dusty surface, and gives added insurance against fuel transmission in vapor form.

Seal Application

Following the prime, Colfix Jet Seal, mixed with some water to free-flowing consistency, was applied with rubber-faced squeegees. Three applications were made in order to get smooth, uniform coverage of one quarter gallon per square yard (based on the material as received in the container). Each squeegee application was brushed immediately and the area opened to traffic as soon as the Jet Seal had set.

For Safety . . . and Long Life

Colfix Jet Seal embodies a coal tar base and oil-proof elastomers that provide an enduring solvent-resistant seal for all bituminous pavements. Its value has been proved on numerous airport runways, parking areas and hard-stands where it effectively protects these surfaces against the solvent action of gasoline and aircraft fuels. In addition, it provides a durable, skid-proof surface that resists heat and weathering.

Colfix Jet Seal is a "bodied" product that fills surface voids. It requires no sand cover. Jet Seal is one of the easiest materials to apply by squeegee, brush or industrial spray equipment. It sets rapidly and the sealed surface may be opened to traffic with a minimum of delay.

For full information on Colfix Jet Seal call our office nearest you.

Here's another typical Colfix Jet Seal job at Baltimore's Friendship International Airport.

Colfix Jet Seal is made by the makers of Walk-Top and Wearcoat—protective coatings for Playgrounds and Tennis Courts used successfully for over 20 years.

AMERICAN Bitumuls & Asphalt COMPANY

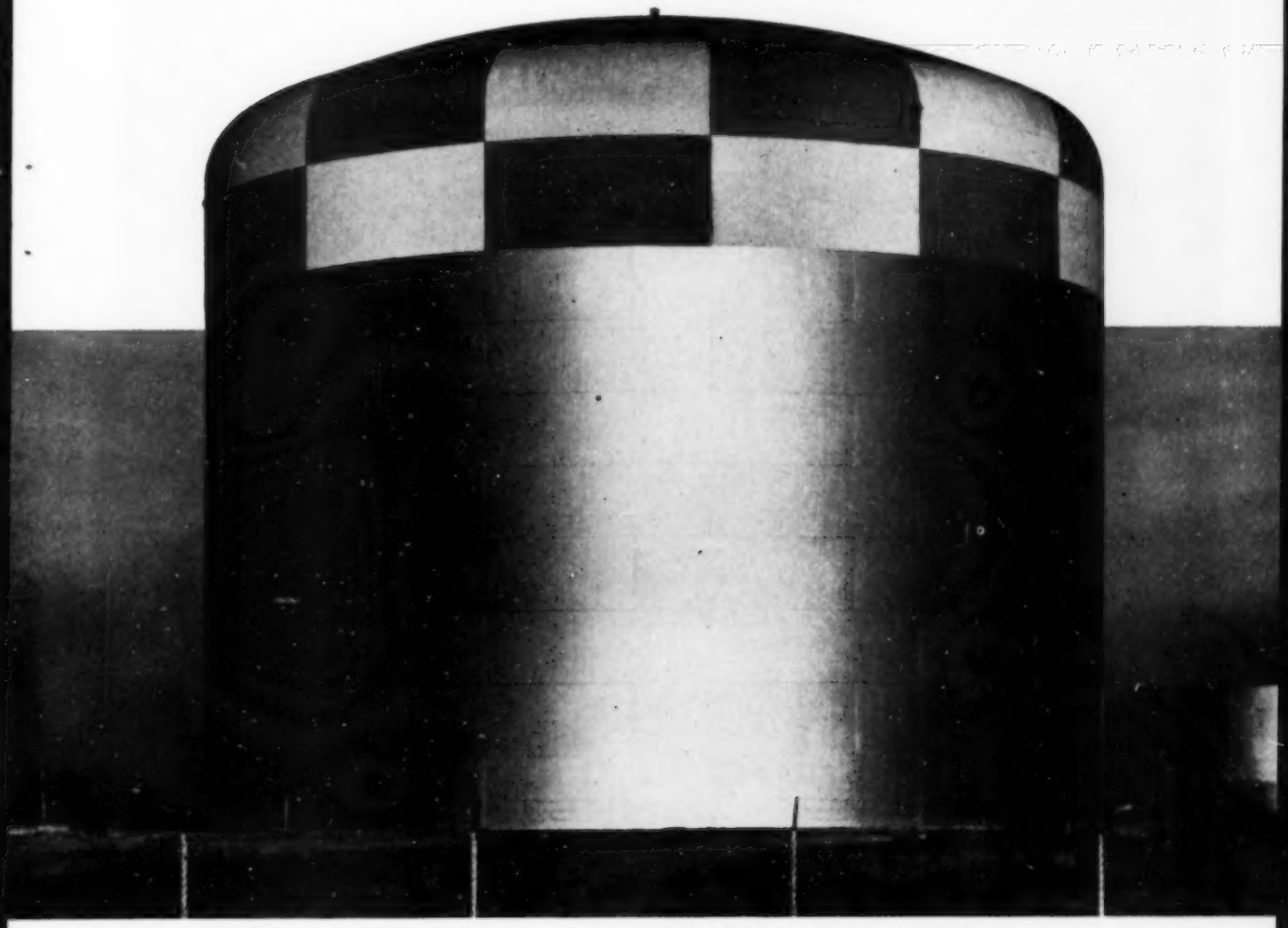
300 BUSH STREET, SAN FRANCISCO 4, CALIFORNIA

E. Providence 14, R. I. Perth Amboy, N. J. Baltimore 3, Md. Mobile, Ala. Columbus 15, Ohio
Tucson, Ariz. Seattle, Wash. Baton Rouge 2, La. St. Louis 17, Mo. Inglewood, Calif.
Oakland 1, Calif. Portland 7, Ore. Washington 5, D. C. San Juan 23, P. R.

NOW—America's Largest Standpipe

(CAPACITY 7,268,000 GALLONS)

for South Pittsburgh Water Company



by PITTSBURGH •DES MOINES

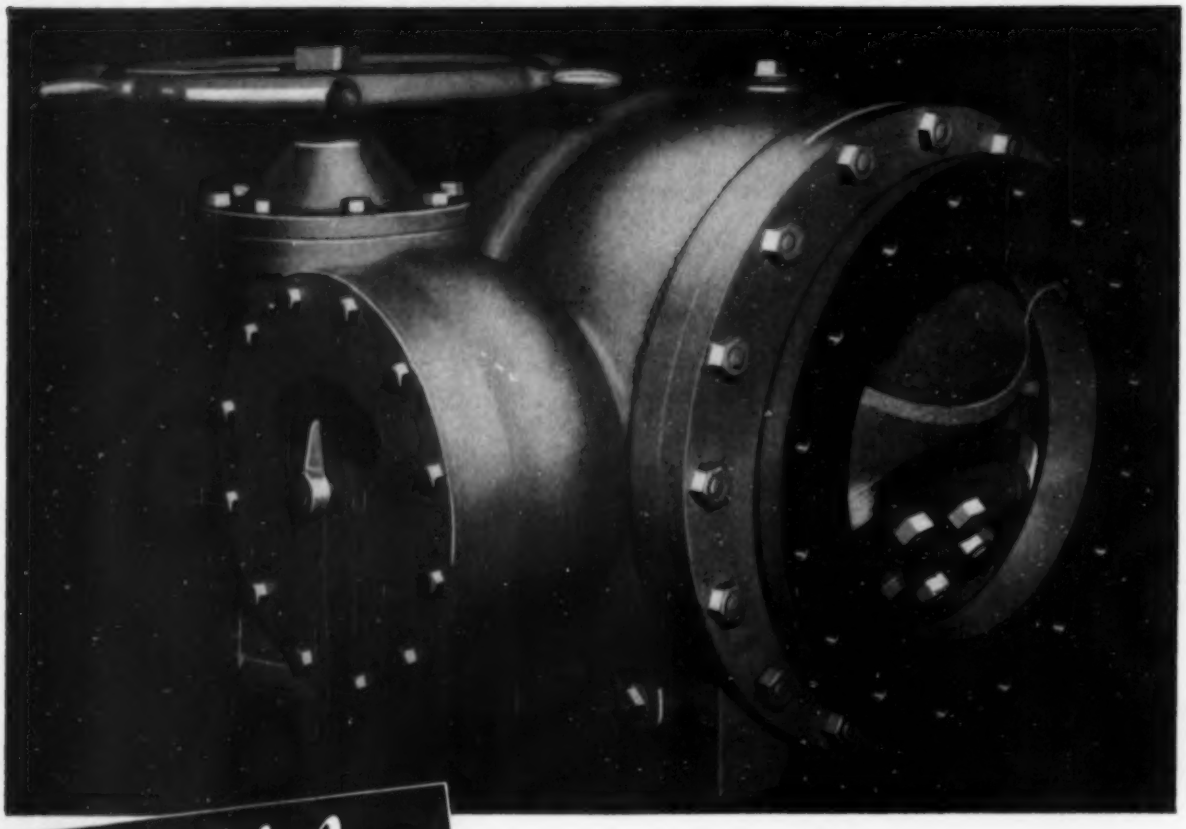
This huge water storage unit evidences typical Pittsburgh-Des Moines fine workmanship in shop fabrication and field erection. Measuring 116 feet in diameter, with a water depth of 95 feet and total capacity of 7,268,000 gallons, the South Pittsburgh Water Company giant is the largest standpipe-type storage tank built in America to date. • Let us quote on your water storage needs.

PITTSBURGH-DES MOINES STEEL CO.

Plants at PITTSBURGH, DES MOINES and SANTA CLARA

Sales Offices at:

PITTSBURGH (25)	3470 Neville Island	DES MOINES (8)	971 Tuttle Street
NEWARK (2)	251 Industrial Office Bldg.	DALLAS (1)	1275 Praetorian Building
CHICAGO (3)	1274 First National Bank Bldg.	SEATTLE	578 Lane Street
LOS ANGELES (48)	6399 Wilshire Blvd.	SANTA CLARA, CAL.	677 Alviso Road



A New Valve by SMITH

THE S. MORGAN SMITH COMPANY introduces the

SMITH BALL VALVE! The first showing will be at the American Water Works Association Convention in Seattle, May 23–28, 1954!

The type and design of this Ball Valve have been proven by performance in many installations.

Be sure to see our Representatives at Booths 146-149 at the Convention, or write us direct for data on the Smith Complete Line of Valves.

S. MORGAN SMITH Co.

YORK, PENNA. U.S.A.

Photo example of tough driving condition met by high strength, cold-rolled Monotube piles.

WHY MONOTUBES ARE *Start-to-Finish* PILES

IN construction work, unanticipated soil conditions can often raise cain with costs, work schedules and foundation designs. That's when you really value the unmatched versatility of Monotube piles . . . for any job *started* with Monotubes can be *finished* with Monotubes.

For example . . . you have a choice of gauges, gauge combinations, tapers, diameters or lengths. Other factors bearing on easy job completion with Monotubes are: simplified weld-splicing in the field to almost any required length; cold-rolled construction for exceptional strength; and top-to-bottom visual inspection before concreting.

Why not get *all* the facts on how Monotube piles offer you an unusual margin of assurance, safety *and economy!* Write to The Union Metal Manufacturing Co., Canton 5, Ohio, for Catalog No. 81.

Monotube Foundation Piles

UNION METAL

ON OUTSTANDING JOBS ACROSS THE NATION

BARCO *is the Answer!*

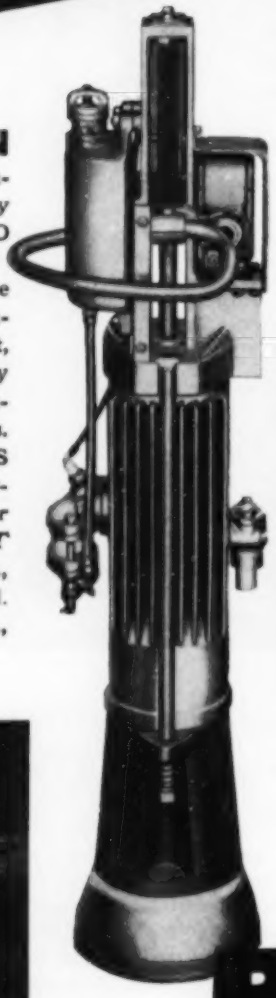
TEXAS DAM—On projects costing millions of dollars, it pays to use construction methods that insure permanence. That's why soil compaction is a very important factor in the construction of dams. This picture shows Barco Rammers working on the Whitney Dam Project on the Brazos River near Whitney, Texas. *Contractors:* L. P. Reed, Inc., and Martin & Grace, Inc., both of Clifton, Texas.

SOIL COMPACTION

is the key to *better construction* on important projects throughout the country —AND ON THESE JOBS, BARCO IS THE ANSWER!

Contractors and engineers, alike, are finding that unless soil is properly compacted during construction, settlement, erosion, and structural damage can easily develop in areas near abutments, foundations and walls, and other critical points.

This is where BARCO RAMMERS quickly pay for themselves! See for yourself—ask for a demonstration. *Send for our latest catalog and new "COST DATA" Bulletin.* BARCO MFG. CO., 561F Hough St., Barrington, Ill. *In Canada:* The Holden Co., Ltd., Montreal, Canada.



OHIO FACTORY BUILDING—The Austin Company recently attracted nation-wide attention with the design and construction of an ultra-modern plant for The Lincoln Electric Company in Cleveland, Ohio. Evidence of the high standards of construction maintained by The Austin Company can be seen in the use of Barco Rammers in the above picture. The Austin Company has many Rammers in use on building projects throughout the country.

MISSOURI HIGHWAY—The State of Missouri has been one of the leaders in studying the value and importance of soil compaction on highway construction for preventing settling, washouts, and erosion. This picture shows Barco Rammers used by Fred Weber Contractors, Inc., St. Louis, on Missouri's famed *Natural Bridge Road.*

BARCO

"Pegson" Gasoline

RAMMER

For Soil Compaction Close to Walls, Culverts and Abutments — in Trenches, Ditches

FREE ENTERPRISE — THE CORNERSTONE OF AMERICAN PROSPERITY

New 2,500,000-Gallon Horton Tank Serves Bethel

The 2,500,000-gal. Horton® radial-cone bottom elevated tank shown above was recently installed by the South Pittsburgh Water Company to improve the municipal water service at Bethel, Penn. The value of the installation is beyond estimation when you total up the benefits for domestic service, commercial needs and fire protection.

For domestic service, it means higher, more uniform water pressures at all times. For commercial and industrial needs it means an adequate supply of water on hand at all times . . . no chance of water shortage to slow down the wheels of industry.

In fire protection, it means greater security, a reserve of water always available to quickly quench flames and reduce property damage . . . . and it often means a better fire insurance rating for the community.

Horton elevated tanks with radial-cone bottoms are built in standard capacities from 500,000 to 3,000,000 gals.—with ellipsoidal-bottoms in standard capacities from 15,000 to 500,000 gals.

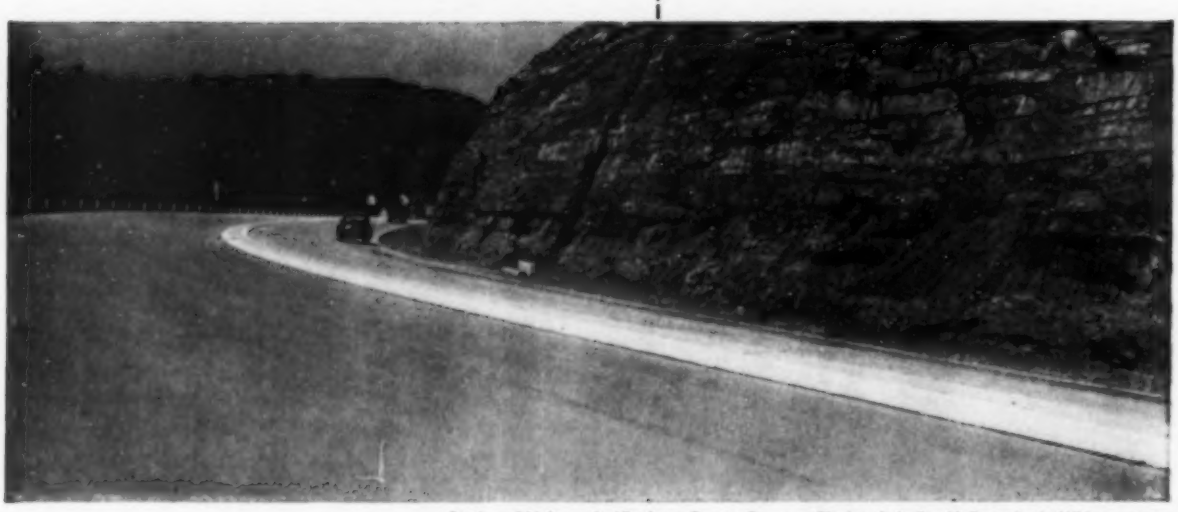
Write our nearest office for estimates or quotations on a Horton elevated tank to improve your community's water system. There is no obligation on your part.

CHICAGO BRIDGE & IRON COMPANY

Atlanta 3.....2167 Healey Bldg.	Detroit 26.....1541 Lafayette Bldg.	Pittsburgh 19.....3210 Alcoa Bldg.
Birmingham 1.....1596 N. Fiftieth St.	Houston 2.....2128 C & I Life Bldg.	Salt Lake City 4.....509 West 17 South St.
Boston 10.....1009—201 Devonshire St.	Los Angeles 17..1556 Gen. Petroleum Bldg.	San Francisco 4.....1584—200 Bush St.
Chicago 4.....2199 McCormick Bldg.	New York 6.....3395—165 Broadway Bldg.	Seattle 1.....1309 Henry Bldg.
Cleveland 15.....2263 Midland Bldg.	Philadelphia 3..1652—1700 Walnut St. Bldg.	Tulsa 3.....1647 Hunt Bldg.

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNA.

This highway was "winterized" when it was built —with DURAPLASTIC



Section of highway in Allegheny County, Pa., near Pittsburgh, built with Duraplastic. White concrete reflecting curbs made with Atlas White Duraplastic. Designed by Pennsylvania State Highway Dept. General contractor: Harrison Construction Company, Pittsburgh; paving sub-contractor: McCrady Construction Company, Pittsburgh; White curb installed by E. Arthur James, Johnstown, Pa.

Come freeze or thaw or de-icing salt, this section of highway near Pittsburgh is ready for the winter's worst, because the concrete was made with Atlas Duraplastic air-entraining portland cement.

Duraplastic makes more durable concrete because it minimizes segregation and bleeding. Thus, concrete is fortified against the effects of freezing-thawing weather and the scaling action of de-icing salts.

Less mixing water is required for a given slump with Duraplastic cement. It makes concrete more workable, more cohesive and more uniform. Naturally, such a mix dumps, spreads and finishes easily. And it allows finishing close to the paver . . . permits earlier protection for curing.

YET DURAPLASTIC* COSTS NO MORE

It sells at the same price as regular cement and requires no unusual changes in procedure. Complies with ASTM and Federal Specifications. For descriptive booklet, write Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 100 Park Avenue, New York 17, N. Y.

OFFICES: *Albany, Birmingham, Boston, Chicago, Dayton, Kansas City, Minneapolis, New York, Philadelphia, Pittsburgh, St. Louis, Waco.*

"Duraplastic" is the registered trade mark of the air-entraining portland cement manufactured by Universal Atlas Cement Company. CEN-0-130

ATLAS®

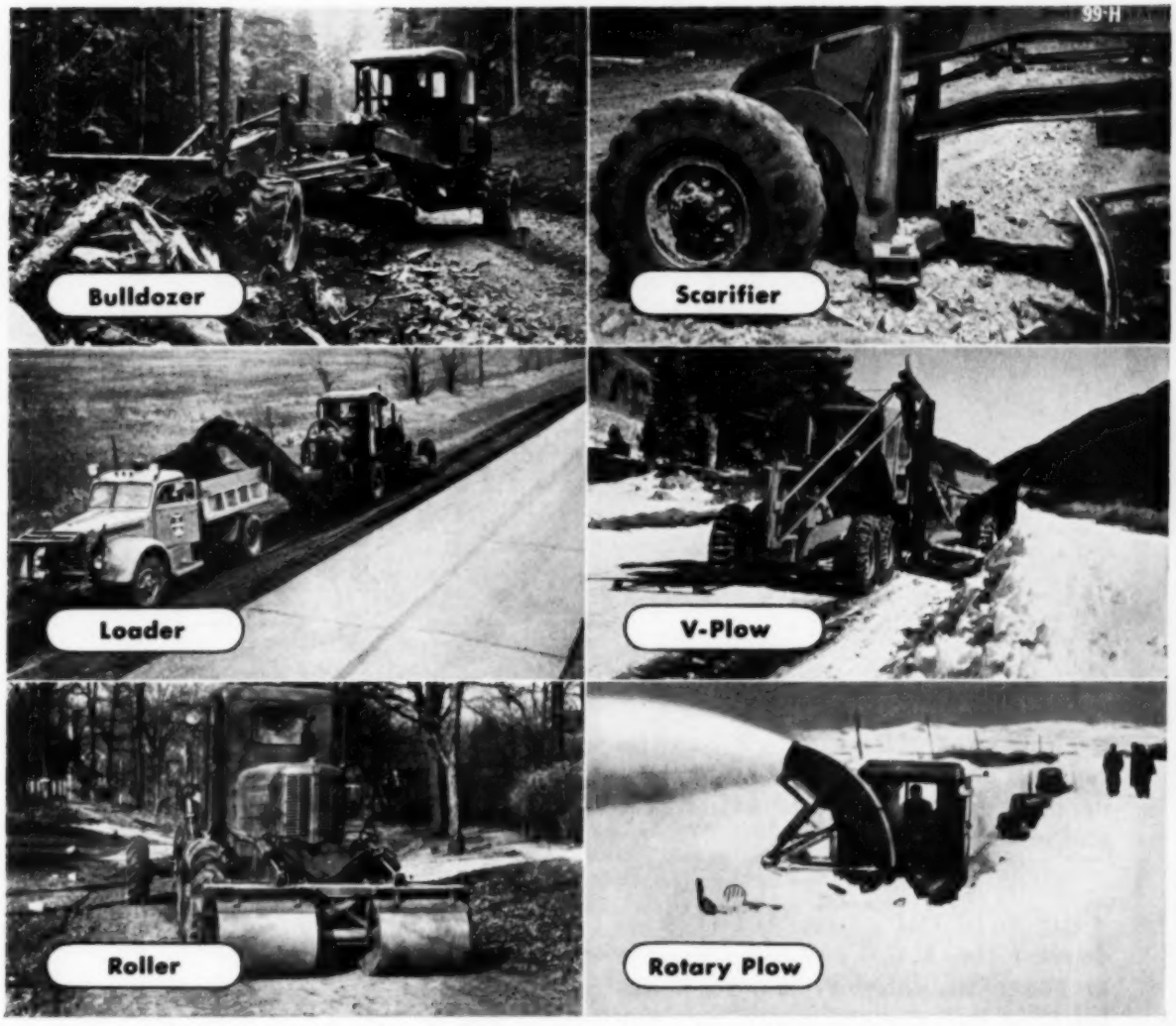
DURAPLASTIC

AIR-ENTRAINING PORTLAND CEMENT

Makes Better Concrete at No Extra Cost

UNITED STATES STEEL HOUR—Televised alternate weeks—See your newspaper for time and station

Only AUSTIN-WESTERN power graders can handle All these profit-making attachments



Thanks to exclusive All-Wheel Drive and All-Wheel Steer, Austin-Western Power Graders handle front and rear mounted attachments with maximum efficiency on jobs where ordinary graders—handicapped by a "dead" front end and lack of rear steer—would suffer through loss of traction or steering control.

An unrivaled line of attachments is available for Austin-Western graders—versatile tools for those extra jobs which mean extra profits—each attachment designed for a type of work frequently done by a separate machine. No ordinary grader can handle ALL of these attachments... no ordinary grader can use ANY attachment as efficiently. *Without* attachments, the Austin-Western Power Grader works more hours each year than conventional graders... *with attachments,* its uses are multiplied and its value increased beyond that of any other grader.

Austin-Western

Power Graders • Motor Sweepers
Road Rollers • Hydraulic Cranes

BALDWIN BLH LIMA HAMILTON
Construction Equipment Division

Manufactured by
AUSTIN-WESTERN COMPANY
Subsidiary of Baldwin-Lima-Hamilton Corporation
AURORA, ILLINOIS, U.S.A.

*$6,750,000,000 of new schools * annually for the next 10 years!*

*$8,000,000,000 of new highways * annually for the next 10 years!*

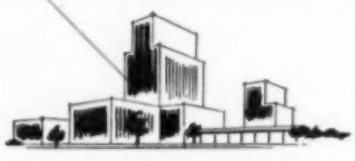
*$1,800,000,000 of water and sewerage facilities *annually for the next 5 years!*

America's community needs

...they can be met now

The construction industry *now more than ever* has the capacity and experience to build these needed facilities quickly, efficiently and economically.

The general contractor who displays the A. G. C. emblem has the proven Skill, Integrity and Responsibility to execute and coordinate the construction operations.



$1,500,000,000 of new hospitals annually for the next 10 years!*

*Minimum annual community needs as reported to the Congress by the President in his Economic Report, January 28, 1954

The A.G.C. Emblem 

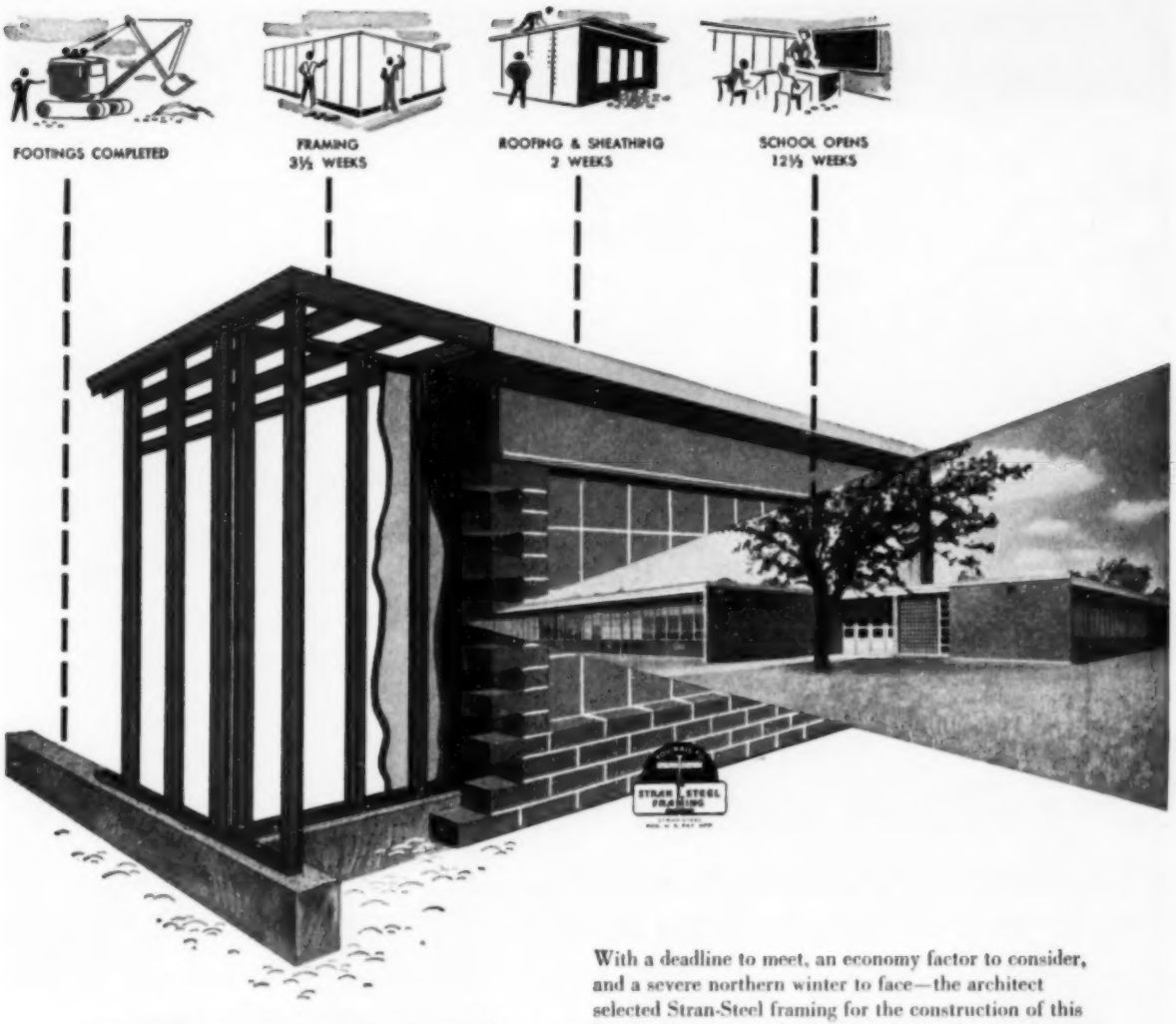
is your assurance

The ASSOCIATED GENERAL CONTRACTORS of AMERICA, Inc.

Representing more than 6,500 of the Nation's Leading General Contracting Firms of Proven Skill, Integrity and Responsibility — Engaged in the Construction of Buildings, Highways, Railroads, Airports, Public Works, Defense Projects

NATIONAL HEADQUARTERS, MUNSEY BUILDING, WASHINGTON 4, D. C.

America Progresses Through Construction . . . Construct by Contract!



STRAN-STEEL® FRAMING

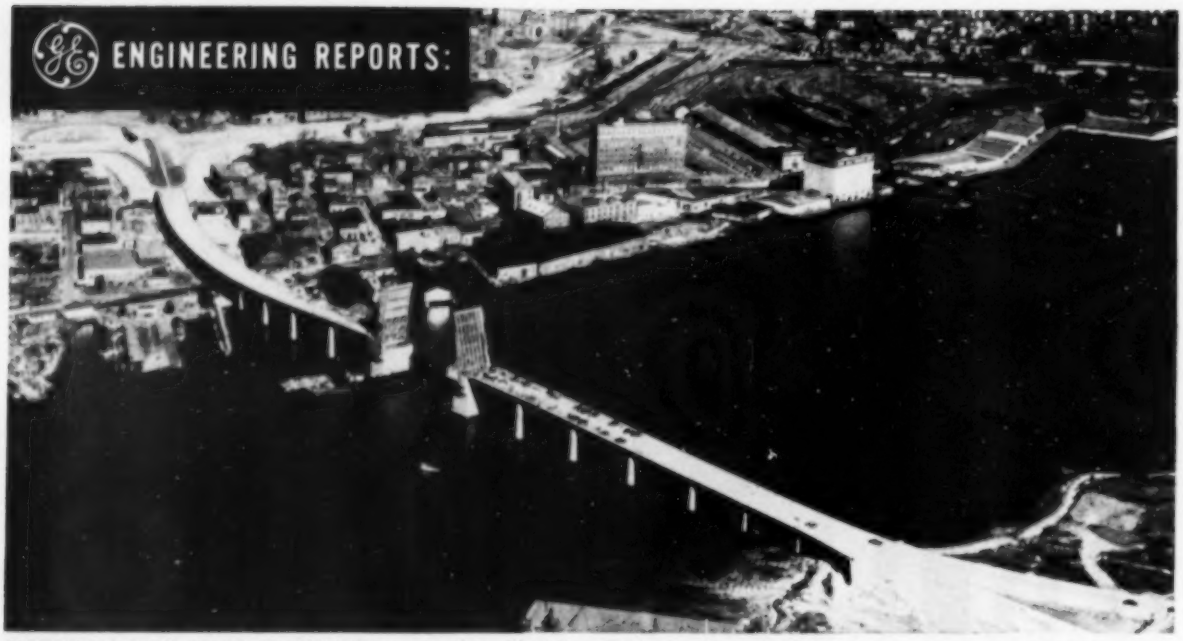
opened this school on schedule at a saving of $5,000!

With a deadline to meet, an economy factor to consider, and a severe northern winter to face—the architect selected Stran-Steel framing for the construction of this Lovell, Minnesota School, District #48. It proved a wise choice for many reasons. The architect, H. B. Crommett, St. Paul, Minnesota, could not afford to take a chance on weather stoppages. Quick erection of nailable Stran-Steel wall frames and the roof-joist system in early fall permitted him to begin immediately on closing-in. With the finished built-up roof and insulating sheathing, and windows installed, a weatherproof interior was completed to permit the building trades to start work. The brick veneer could be installed at any date when weather permitted.

Actual working time was approximately 4½ months and the cost was estimated by the architect to be $5,000 less than any other comparable material he might have used. Again, the versatility and adaptability of Stran-Steel framing helped the architect and the general contractor to do a good job, quickly and economically. Adolphson and Peterson, of St. Paul was the general contractor.

Write for this explanatory booklet.

GREAT LAKES STEEL CORPORATION
Stran-Steel Division **Ecorse, Detroit 29, Mich.**
NATIONAL STEEL CORPORATION



MOTORISTS SAVE 10 TO 30 MINUTES crossing from Norfolk to Portsmouth via the new G-E equipped bridge and tunnel. Bridge is 4-lane, 2135 ft between abutments. Bascule span is of the double-leaf, rolling-lift type with leaves each 90 ft long.

Bridge's drive system helps speed 29,000 cars per day

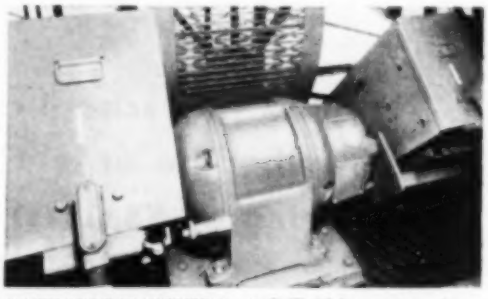
G-E equipment at Portsmouth - Norfolk Bridge gives fast movement, positive control of leaves

The new 4-lane bascule bridge across the Elizabeth River at Norfolk, Va.—part of a combined bridge and tunnel project built for the Portsmouth–Norfolk Bridge Tunnel Commission—is currently handling over 29,000 vehicles per day. Ability to handle this heavy traffic flow is due in part to electric equipment supplied and co-ordinated by General Electric.

In helping to develop the bridge's drive system, G-E engineers worked closely with J. E. Greiner Co., consulting engineers, Tidewater Construction Corp., engineers and contractors, and Tuck and Kendall Inc., electrical contractor. Result of this co-operation: a simple, dependable drive system that expedites traffic because it is easy to operate and provides positive-action control of bridge leaves for fast movement and smooth, safe seating.

This is one more example of how G-E engineers can help your engineers or consultants on electric equipment for heavy construction projects. For other examples of how G-E application engineering has been utilized on many of the important bridge "firsts" throughout the country, contact your local G-E Apparatus Sales Representative or write for a copy of GED-1982. General Electric Co., Schenectady 5, New York. 664-26

POSITIVE-ACTION CONTROL of span motors is centered in this G-E operator's desk. Fine-scale selsyn dial pinpoints position of each leaf during seating.

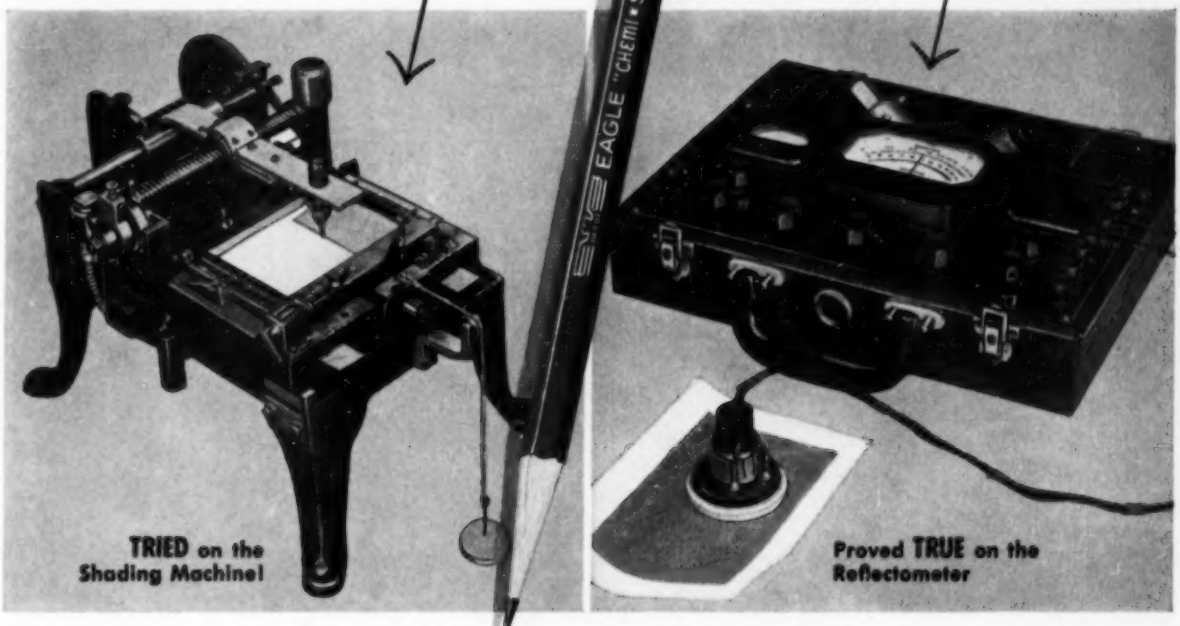


EACH LEAF IS MOVED by 2 G-E 25-hp motors (one shown). G-E motor control center, operated from desk, controls these and tail locks, gates, barriers.

Engineered Electrical Systems for Heavy Construction

GENERAL ELECTRIC

TURQUOISE GRADING *is tried and true!*



A test pencil is first weighted to average drawing pressure and inserted in this exclusive Eagle Shading Machine. The machine then moves a sheet of paper back and forth beneath the point. Because all other factors are equal, the blackness of the shading depends solely on the trueness of the pencil grade.

The chart prepared by the Shading Machine is then placed under the electric eye of this Reflectometer calibrated to black and white glass standards. The sensitive dial indicates the blackness of the shading to a fraction of one percent . . . and *proves* the test pencil true to grade!

Because each of the 17 TURQUOISE grades is made from a separate formula . . . and because each grade is both *tried* and *true* . . . TURQUOISE will give you exactly the line you want every time!

PROVE IT YOURSELF. Write us for a sample of the new TURQUOISE in any degree you desire. Please name this publication.

EAGLE *"Chemi-Sealed" (Super Bonded) TURQUOISE *Drawing Pencils & Leads*
With 100% *"Electronic" Graphite

*®

Eagle Pencil Company • New York • London • Toronto • Mexico • Sydney

An eagle's eye view showing progress on the Congress Street Expressway Chicago Illinois

Allied has the special

SKILL AND FACILITIES

to fabricate and erect the structural steel for super highways, freeways, and bridges of all types

The Congress Street Expressway, Chicago, Ill. Illustrating one of eight sections with a total of 7800 tons. Now under construction by Allied for the Cook County Illinois Highway Department.

Plants in Chicago, Illinois • Hammond, Indiana • Clinton, Iowa

Lithographed on stone for U. S. Pipe and Foundry Co. by John A. Noble, A. N. A.

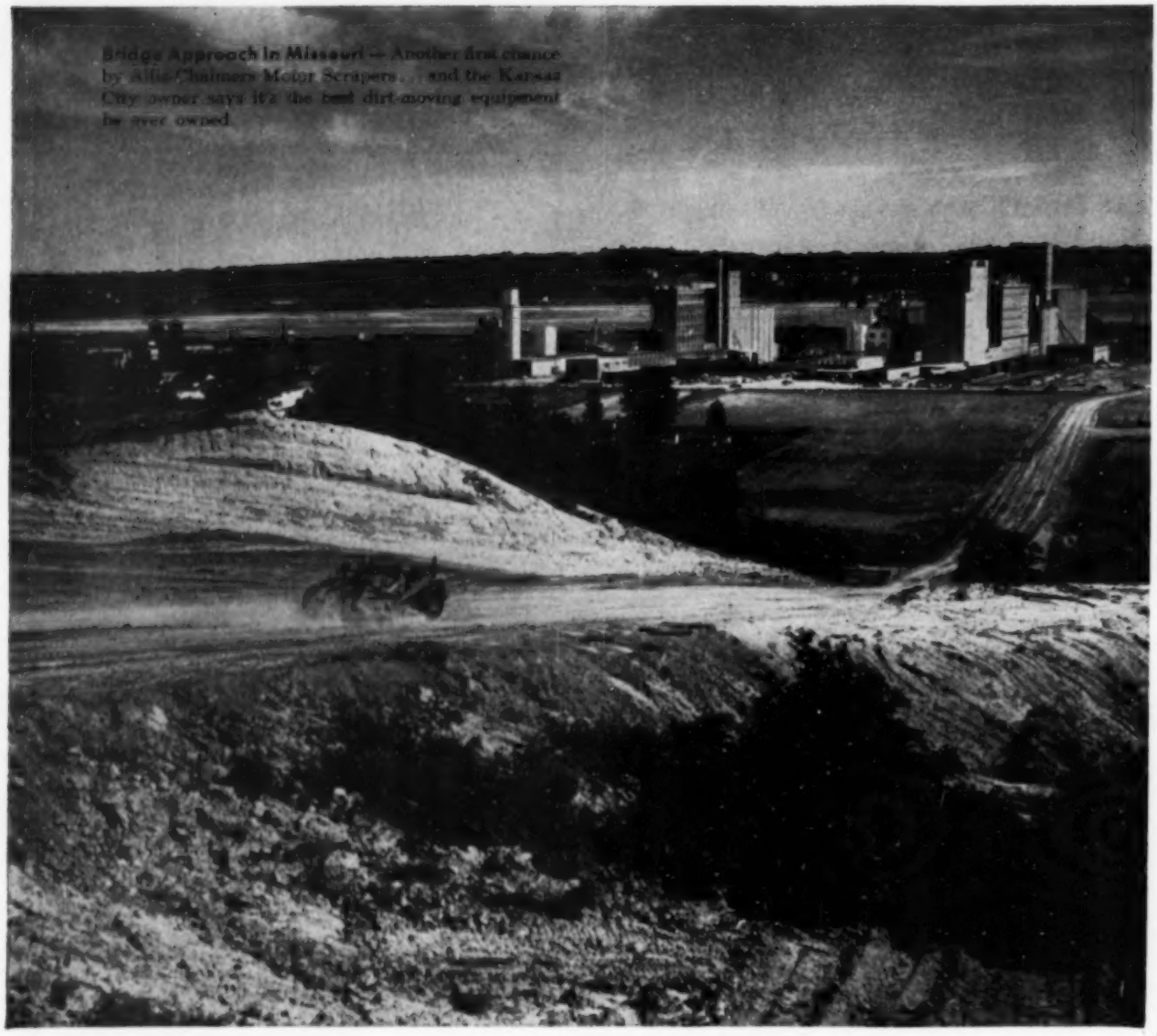
CAST IRON PIPE being unloaded as shown above may be for use in the city's water, gas or sewerage system. The more-than-a-century service record of cast iron pipe in this country is a strong reminder that the installation of this pipe will be not only for the benefit of the present generation but for many more to follow.

U. S. cast iron pipe, centrifugally cast in metal molds, retains the good characteristics of the older type of pipe and incorporates the superior properties of strength and uniformity imparted by this modern casting process and quality controls.

We are well equipped to furnish your requirements for cast iron pipe and fittings made in accordance with American Standard, American Water Works Association and Federal specifications. U. S. pipe centrifugally cast in metal molds is available in sizes 2- to 24-inch and pit cast pipe in the larger sizes.

U.S.
cast iron
PIPE
FOR WATER, GAS, SEWERAGE AND INDUSTRIAL SERVICE

United States Pipe and Foundry Co.,
General Office, 3300 First Ave., N. • Birmingham 2, Ala.
Plants and Sales Offices Throughout the U. S. A.



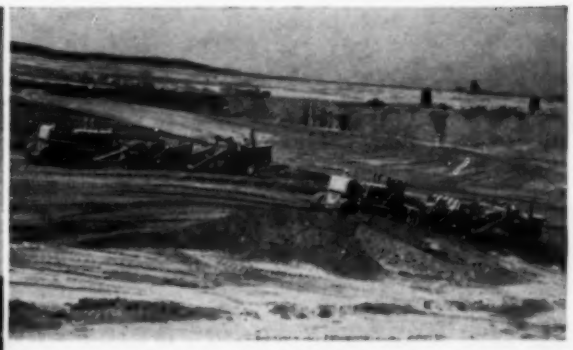
Bridge Approach in Missouri — Another first chance by Allis-Chalmers Motor Scrapers . . . and the Kansas City owner says it's the best dirt-moving equipment he ever owned.

Today's Contractors are Keen Judges of Equipment

On earth-moving jobs all over the country, design, performance and service features that were once taken for granted are now getting a careful look . . . because even one extra yard per load, one extra mph. on the haul road can make a big difference when it comes to staying within bidding estimates.

That's why you see Allis-Chalmers Motor Scrapers and Motor Wagons on more and more big construction projects like those illustrated here. Cost-conscious, profit-conscious contractors have analyzed them, used them and have satisfied themselves that Allis-Chalmers Motor Scrapers have what they need to help them win bids, stay on schedule and make a profit when they are through with the job.

If you have your sights set on some close-margin, hard-to-get business, we *know* it will pay you to go over *all* the facts with your nearby Allis-Chalmers dealer.



Housing Project in California — Here, six big TS-300's and their HD-20 partners team up at the Westlake job near San Francisco . . . for a contractor moving over 8,000,000 yards in the last five years.

Runway Extension in Tennessee — This TS-300 is the first Allis-Chalmers equipment this contractor has ever owned, but it earned a regular spot fast by high-balling capacity loads like this trip after trip.

Dam-Building in Illinois — and the fleet color is Persian Orange. The 176 hp. TS-200's and HD-20's load smoothly, efficiently . . . and the TS-200 is rolling fast toward the fill the instant they break contact.

Railroad Bed in Montana — These TS-300's (14-yd. struck capacity; 18-yd. heaped capacity) averaged 14 trips an hour, excavating grade for a five-track rail bed at the site of a new aluminum plant.

Jet Base in Jersey — Silt and sand make this a tough job . . . but the extra power of the TS-300's, plus the HD-20's ability to exert full power at creep speeds, paid off in big yardage.

ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

Precast Bridge 2 Miles Long

122-Ton Roadway Slabs Floated into Place with Assembly-line Precision on Bay St. Louis Bridge, Mississippi

119,035 BBLS. LONE STAR AIR-ENTRAINING CEMENT USED

● First conceived as a cast-in-place structure, substantial time and money savings were realized by precasting the roadway of this 4-lane, 10,189-ft. bridge carrying U. S. 90 across the Bay of St. Louis.

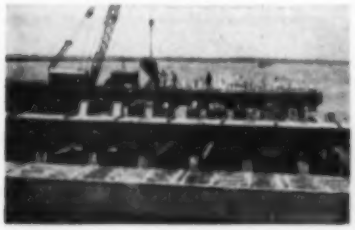
Concrete pile bents on 41-ft. centers support the precast bridge deck. The 2456 concrete piles and 478 half-width roadway units were fabricated at an onshore casting yard near job site.

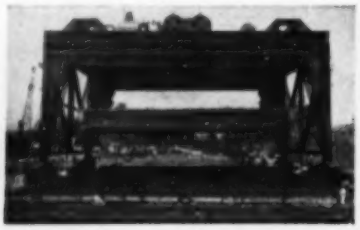
Roadway units, each 27½ x 41 ft., containing 57½ cu. yd. concrete and weighing 122 tons, were moved by gantry to barge, towed to bridge line, and lowered into position by gradually flooding barge ballast compartments.

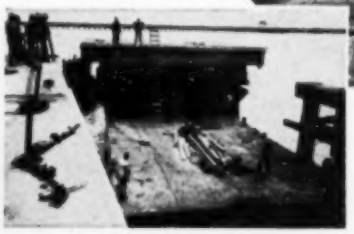
Work on the $6.5-million structure, proceeding from both shores to mid-way juncture, was completed 18 months after driving first pile.

A construction achievement of first rank, made possible by assembly-line precision at every stage—including perfect timing of material deliveries. You could set your watch by dependable schedules on which 119,035 bbls. of LONE STAR AIR-ENTRAINING PORTLAND CEMENT were delivered. The notable workability of this cement helped speed placing and finishing. Extra durability assures long-time, fire-safe service—lowest annual cost.

STATE OF MISSISSIPPI—Toll Project No. 1 (Contract No. 1)
BAY ST. LOUIS BRIDGE, between Bay St. Louis and Henderson Point
Supervision: **MISSISSIPPI STATE HIGHWAY DEPARTMENT**
Designed by: **HAZELET & ERDAL**, Consulting Engineers, Louisville, Ky.
General Contractor: **MERRITT-CHAPMAN & SCOTT CORPORATION**, New York







LONE STAR CEMENTS COVER THE ENTIRE CONSTRUCTION FIELD

LONE STAR CEMENT CORPORATION

Offices: ABILENE, TEX. • ALBANY, N. Y. • BETHLEHEM, PA. • BIRMINGHAM
BOSTON • CHICAGO • DALLAS • HOUSTON • INDIANAPOLIS
KANSAS CITY, MO. • NEW ORLEANS • NEW YORK • NORFOLK
PHILADELPHIA • RICHMOND • ST. LOUIS • WASHINGTON, D. C.

LONE STAR CEMENT, WITH ITS SUBSIDIARIES, IS ONE OF THE WORLD'S LARGEST CEMENT PRODUCERS: 18 MODERN MILLS, 136,000,000 SACKS ANNUAL CAPACITY

Editor • Walter E. Jessup

Associate Editor • Robert K. Lockwood

Assistant Editors

Articles • Ruth G. Campbell

News • Mary E. Jessup

Production • Doris A. Braillard

Advertising Manager • James T. Norton

EDITORIAL & ADVERTISING DEPARTMENTS
33 West 39th Street, New York 18, N. Y.

Advertising Representatives
are listed on Index to Advertisers page

ASCE BOARD OF DIRECTION

President

Daniel V. Terrell

Vice Presidents

Enoch R. Needles — G. Brooks Earnest
Edmund Friedman — Mason G. Lockwood

Directors

Walter D. Binger — Frank A. Marston
A. A. K. Booth — George W. McAlpin
Ernest W. Carlton — Chas. B. Molineaux
Francis M. Dawson — Samuel B. Morris
Raymond F. Dawson — Warren W. Parks
Oliver W. Hartwell — Carl G. Paulsen
James A. Higgs — Thomas C. Shedd
Glenn W. Holcomb — Mercel J. Shelton
Lloyd D. Knapp — I. Cleveland Steele
Wm. S. LaLonde, Jr.

Past Presidents

Carlton S. Proctor — Walter L. Huber

EXECUTIVE OFFICERS

Executive Secretary • William N. Carey
Assistant Secretary • E. Lawrence Chandler
Treasurer • Charles E. Trout
Assistant Treasurer • George W. Burpee

The Society is not responsible for any statements made or opinions expressed in its publications.

Subscription Rates—Price 50 cents a copy. $5.00 a year in advance; $4.00 a year to members and to libraries; and $2.50 a year to members of Student Chapters. Canadian postage 75 cents and foreign postage $1.50 additional.

Printing—Reprints from this publication may be made on condition that full credit be given to the author, copyright credit to Civil Engineering, and that date of original publication be stated.

Copyright, 1954, by the American Society of Civil Engineers. Printed in U.S.A.

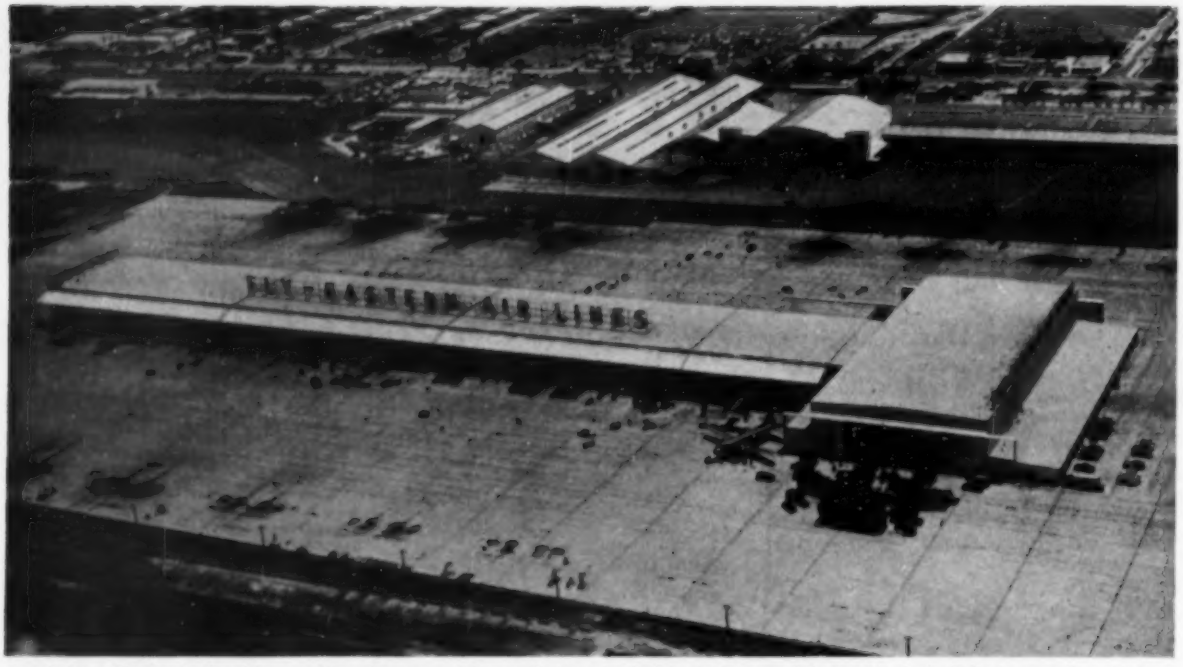
Member Audit Bureau of Circulations
42 700 copies of this issue printed

CIVIL ENGINEERING

MAY 1954

THE MAGAZINE OF ENGINEERED CONSTRUCTION

• CONTENTS • VOLUME 24 • NUMBER 5



Aerial view of Eastern Air Lines' base at Miami International Airport. Maintenance building in foreground designed by Leslie B. Taylor, consulting structural engineer, of Miami. Construction supervised by J. Herbert Shartle, Eastern Air Lines engineer. Steelwork fabricated and erected by Bethlehem Steel Company.

World's Largest Maintenance Hangar

This mammoth building, dwarfing the planes on its concrete ramp, is Eastern Air Lines' new $5,000,000 maintenance hangar, largest and most modern of its kind in the world.

Built in the shape of a T, the three-story structure stretches nearly a quarter of a mile from end to end. The stem of the T provides fourteen work ports, seven on each side, while the huge hangar crossing the T accommodates two Super-Constellations. In addition, the 448,748 square feet of floor space contains maintenance offices, overhaul shops, stockrooms and a large, one-story warehouse.

The sturdy framework of this remarkable building consists of 3082 tons of structural steel, fabricated and erected by Bethlehem Steel Company. Erecting an average of almost 100 pieces of steel every day, Bethlehem completed the job in just 70 working days.

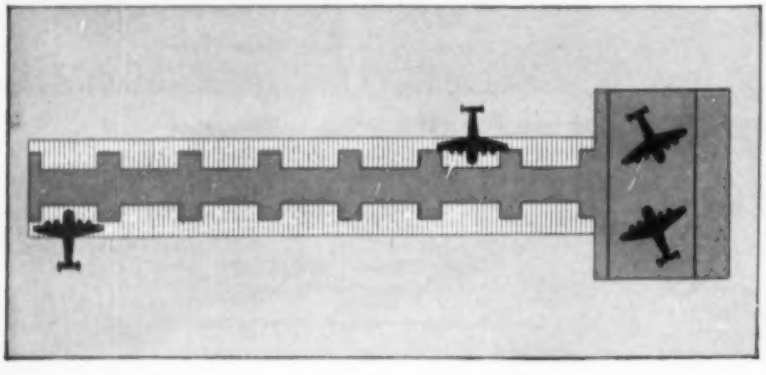
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Plan view of ground floor. Thin lines indicate overhanging roof supported by cantilevered trusses.



View of steelwork for 1219-foot-long hangar.

CIVIL ENGINEERING

MAY 1954

THE MAGAZINE OF ENGINEERED CONSTRUCTION

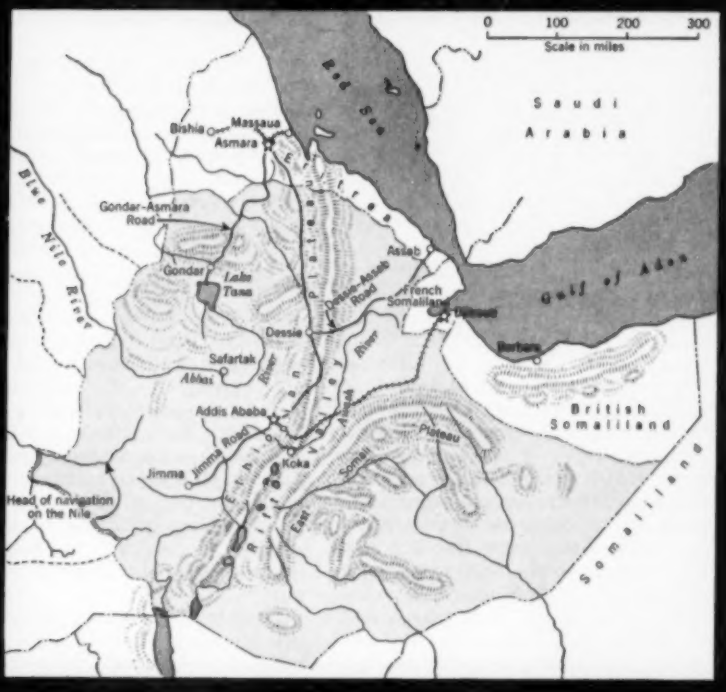


FIG. 1. Ethiopia, formerly largely isolated from outside world, has recently initiated forward-looking programs in various fields of engineering. Much of terrain is rugged and many rivers rush precipitously from high plateaus to valleys below.

ETHIOPIA—land of promise

Opportunities abound for achievement in civil engineering

PERRY A. FELLOWS, M. ASCE

Director of Planning,

Addis Ababa, Ethiopia

Engineers cannot fail to be interested in the broad and far reaching program now being carried out in Ethiopia—a country that until recently was little known to the outside world. His Imperial Majesty, Haile Sellassie the First, Emperor of Ethiopia, has brought his people and the progress they are making to the favorable attention of many other countries. These achievements, here discussed, have been carried out almost entirely during the 24 years since his coronation. The key to this success lies largely in the magnetic leadership and tireless drive that characterize this ruler.

One American civil engineer, after a quick reconnaissance of most of Ethiopia by airplane, automobile, and mule, said, "This is the country engineers dream about!" A year later that same engineer, turning his back on a good job in the States, had returned to Ethiopia. When his second visit had lasted long enough for the newness to wear off and he had seen more places, and experienced the changing seasons and various working conditions, his opinion was more valuable. His revised appraisal was, "Ethiopia is an engineer's paradise!"

What are the specifications for an engineer's paradise? No doubt these would vary with the individual engineer, but many of course would receive general approbation.

To begin with, Ethiopia is a rugged country and to nearly everyone it is still a land of mystery. Within a distance of about 150 miles it plunges from the elevation of a mountain peak at 16,000 ft above sea level to hundreds of feet below sea level. Viewed from the stratosphere, it probably would resemble a jig-saw puzzle with the pieces set together in a loose fit. The pictured surfaces would be the comparatively level tops of two great plateaus and the floor of the valley that lies between them. The spaces

separating the pieces of the puzzle would be the steep-sided river valleys.

These deep valleys have been worn by the waters which during heavy rains rush precipitously from the high plateaus to the low ground that begins at the base of the escarpment. The walls of the canyons thus cut reveal the geological history of the country. In the Cretaceous period the area now occupied by Ethiopia slowly rose like a great bubble above the level of its surroundings. Then the arch of the bubble failed and foundered, leaving the two halves separated by what is now known as the Rift Valley. The high land left on the west is the Ethiopian Plateau and that on the east is the Somali Plateau.

Volcanic disturbances have left their marks on the plateaus as well as in the valley. The cones are now almost wholly extinct but some are recent and some contain quiet, gem-like lakes. There are many other lakes besides those in the craters of extinct volcanoes. Some mark the bottom of the Rift Valley and some are scattered over the surface of the plateaus. The largest is Lake Tana with an area of 1,100 sq miles, only a few square miles smaller than the state of Rhode Island. The Attai River, which flows from Lake Tana, is known as the Blue Nile in the Sudan, where it joins the White Nile at Khartoum. Just below the outlet from Lake Tana, there is a great waterfall which, with an island on its lip, resembles Niagara, and in the rainy season rivals it for impressiveness. There are other falls in Ethiopia, of which two are among the world's highest. The weathered surfaces of the plains have produced a laterite soil, most of which is of remarkable richness and depth.

It is in this setting that the Ethiopian people live, about 15 million in an area of about 350,000 sq miles. They are of mixed ancestry with Hamitic and Semitic predominating, and of these Semitic is the latest and most potent admixture. They are independent, active, and intelligent. Their natural surroundings and their unwillingness to abandon either their freedom or their faith have combined to keep them isolated until recently from progress in other parts of the world. On their own initiative they discovered the disparity between their own civilization and that of the West, and on their own initiative they undertook to correct this situation. The beginning of the program of correction antedated by many years the birth of the international technical cooperation programs now in effect but there is a remarkable similarity in method. The striking difference arises from the fact that the control, responsibility, and cost of the earlier Ethiopian plan was entirely her own. It has been relatively easy to incorporate the new technical cooperation programs into the earlier local development plans.

Since these new programs are designed to expedite the accomplishment of the improvement program Ethiopia had already undertaken, they have been accepted in the spirit in which they are offered. The fact that general information is available on the various projects as to site, personnel, and plan, makes the country particularly attractive to engineers. Engineers are already active in Ethiopia and are participating in a number of programs. In some of these the engineer plays the leading role and in others his work is essential but not so obvious. It is important to note that if engineering know-how were withdrawn, even that which seems the most remotely associated with results, the program would lose its essential core. It would no longer be a program of modernization.

Isolation is basic problem

The work now being done is planned to strike at the root of the problem, which is isolation, both natural and self imposed. The engineer has joined in the effort to break down this isolation. Port development, transportation, communication, and education are obvious and direct means to this end. Urban improvements and the development of water resources, industry, agriculture, commerce, and trade are just as important in their way.

It is not necessary to spell out either the engineer's relationship to the basic elements of the program or his interest in the accomplishments sought. It is only necessary to recall that all science and technology, the real basis of any such modernization program, require the use of advanced mathematics as a tool. Isolated Ethiopia did not have this essential tool and therefore could not keep abreast of modern technological developments. The engineer is then an essential part of the modernization program. But to be effective his work must be related to the more basic changes now under way.

By action of the United Nations, Eritrea ceased to be an Italian colony and entered a close federation with Ethiopia. This federation has improved the transportation situation by making the sea accessible to Ethiopia. Along the Red Sea coast of Eritrea there are two ports, Massaua and Assab. Djibouti is another port on the Red Sea that serves Ethiopia but commerce there must pass through a French toll gate since Djibouti is French. Berbera, a little further down the coast, is British, and Mogadishu on the Indian Ocean is for the present in Italian hands. To be effective, Assab must be developed, and Massaua must be maintained.

Before federation with Eritrea in 1952, Ethiopia was shut off from sea. Now it has two ports on Red Sea, Massaua, here pictured, and Assab, now being developed.

Contact with the rest of the world through the channels of commerce cannot stop at the port but must reach back into the country to the places where the products originate and where the imports are consumed. One of Ethiopia's important highways connects Assab to Addis Ababa. A well planned road had been hurriedly built by the Italians, but because of the war and the ravages of time it had become almost impassable by the time Assab became Ethiopian in September 1952. Now it is an excellent highway, rebuilt across the desert under difficult conditions.

Other highways have been rebuilt and repaired since the Imperial Highway Authority began its program three years ago. Money appropriated for that purpose by the Ethiopian Government was supplemented by an interest-bearing loan from the World Bank. The improved highways which radiate from Addis Ababa make it possible to put Ethiopian surplus products in foreign markets more quickly and at a lower price than before, and thus they earn more dollars to support projects for development.

Long span bridges
Abbai River

One of the most interesting engineering projects encountered in the transportation program, but not included in the Imperial Highway Authority program, was the bridging of the Abbai River. The highway running north from Addis Ababa toward Lake Tana crosses the deep valley of the Abbai at Safartak. Here a Melan arch was built to span the stream. It is one of the longest Melan spans in the world and there are several interesting and unusual facts associated with its design and construction. The span is about 394 ft and the arch rises 164 ft. The contract for construction was let on a non-competitive basis and included the necessary engineering for the design. There was a minimum of engineering supervision by the government during construction. There was an almost complete absence of the critical public review of design and construction that is afforded gratuitously for almost every unusual structure in the West.

Above:
Rugged mountains pose some unusual problems for road builders. Here wall on Welkifit Mountain supports section of Gondar - Asmara Road.

Right:
Road building machinery mixes and places 2 kilometers (1.2 miles) of bituminous surfacing a day on Jimma Road.

Right:
Mechanized equipment does grading and cuts side ditches on Mojjo-Wondo road. Vegetation here is semitropical in character.

Right:
Highway between Addis Ababa and Dessie has recently been extensively repaired. Five ridges are crossed between Dessie and Asmara. At least one peak in vicinity, Mount Ras Dashan, is higher than Mont Blanc.

The improvement and extension of telecommunications is going forward under circumstances similar to those associated with the highway program. A similar administrative organization, Imperial Telecommunications Authority, is also financed by an Ethiopian Government appropriation and an interest-bearing loan. To do justice to any one of the many engineering problems that these organizations meet and solve would require a long story.

One of world's longest Melan arches carries highway over Abbai River (Blue Nile) at Safartak. Span is 394 ft and rise 164 ft. Construction view, above, shows rugged nature of valley running between cliffs. Here climb to plateau far above is just beginning.

Education—a far-reaching program

It is obvious that these projects and others cannot be left indefinitely in the hands of foreigners. That would be neither practicable nor desirable, so Ethiopians are being trained for technical and administrative work. More will be trained. This training is not the work of the operating organization alone. Basic training and the accompanying education must be and is given by the public shcools.

The whole educational program, including scholarships abroad, is an important part of the plan to overcome isolation. It provides one of the best means to insure that cross fertilization of ideas from which real progress comes.

It was necessary for the educational program to begin almost at the bottom. Although the Emperor Menelik II had made a good start by building a few schools and sending some students abroad, the fruits of his efforts were almost completely lost. Those thus educated were among the leaders who resisted invasion, and many were killed during the occupation and the war of liberation. The surviving leaders were so few that they were hardly able to man a skeleton government structure.

The new program thus had to provide leaders for every specialized facet of culture as well as for its broadest and most comprehensive aspects.

Such an educational program obviously could not be brought into being at once, completely equipped, fully staffed, and with classes filled from kindergarten to university. Students who had some beginning training were sent abroad. The emphasis in Ethiopia at the start was put on practical technical training and on building up the elementary schools. As rapidly as pupils were ready to fill the classes, secondary schools and specialized schools were provided. Now the colleges provide higher education. The university includes a fine arts college and an engineering college. There are also colleges and comparable schools that provide training in agriculture, commercial and business subjects, and teaching. Training in mechanical and other specialized fields has gone forward, and each year it is possible to draw recruits with better basic training from the elementary and secondary schools. There are now about sixty thousand boys and girls in the public schools. There are schools in every province, widely distributed and coeducational. There is no discrimination between Christians, Moslems, Jews, and other faiths. The interest continues to be divided between practical training and cultural studies, with emphasis on the development of qualified leadership.

Ethiopia's economy is basically agricultural and pastoral and it follows that the leadership should be trained with this fact in mind. An agricultural school has been functioning for several years. In the public schools, increasing emphasis is being placed on studies relating to agriculture. A junior agricultural college has been in successful operation at Jimma during the past year. The Technical Cooperation Administration has participated in its sponsorship and in that capacity is represented by Oklahoma Agricultural and Mechanical College. This same sponsorship extends to a new Imperial Agricultural College authorized but not yet built. Interested people in Ethiopia have proposed that the same kind of sponsorship be arranged with an American engineering college.

Water resources and power under study

Uneven distribution of rainfall during the year creates a demand by agriculture for the services of the water resources engineer. Such engineering service is also needed to make up for the lack of large reserves of cheap fuel for industrial purposes. The steep gradients of the stream beds and adjacent watersheds create a need for holding back the rapid runoff from the mile-high plateaus.

For these reasons a project has been established to study the feasibility of multipurpose dams. A specific location at Koka, about fifty miles southeast of Addis Ababa, is now being surveyed. With the technical assistance of U.S. Bureau of Reclamation personnel, supplied by Point IV, the Ethiopian Government is examining the possibility of building a dam across the Awash River there.

The Awash is a perennial stream that rises northwest of Addis Ababa and traces a curving path as it drops off the Ethiopian plateau, first south, then turning gradually until it flows almost north through the rich plains at the bottom of the Rift Valley. Many observers, noting the presence of this large stream beside the fertile plains, have urged the adoption of irrigation. They would transform the vast expanses of grass lands, where Nomad herdsmen share their unfenced pastures with antelope, ostrich, zebra and wild hog, into orchards of fruit and coffee, or intensively cultivated fields of cotton and vegetables.

The site selected by the Italians for a project here corresponds closely with the one now under consideration. The following data are tentative and may be changed on completion of the current surveys:

Height of dam	85 ft
Length of dam and dikes	1,312 ft
Capacity of reservoir	1,045,000 acre-ft
Capacity of power plant	500,000,000 kw per year
Length of transmission line to Addis Ababa	56 miles
Power delivered at	150 kv

Addis Ababa is impatient for the development of a source of cheap, dependable power, and this site appears to be the most likely to furnish early relief. This project also is well situated to demonstrate the value of irrigation as one way to increase exportable agricultural surpluses to neighboring countries that so often see famine.

Studies are also under way on other streams, including the Abbai River. This stream emerges from Lake Tana, an immense natural reservoir, and descends by rapids, cataracts, and finally by a Niagara-like falls, into a deep rock-sided gorge. This gorge is quite narrow in some places and in one place in particular the top could be spanned from side to side by a simple beam less than 20 ft in length.

Much has been written about the possibilities of controlling the waters of the Abbai. It has been the subject of discussion at the highest international level between the nations most concerned. It has been studied by several engineering expeditions. One of the most interesting social problems involved is the water level in Lake Tana. Along the shores of this lake and on the small islands in it are many churches and sacred places. Religion is taken very seriously in this country, and the engineer who would disregard the effect of his construction projects on these shrines is not likely to complete his work without revision.

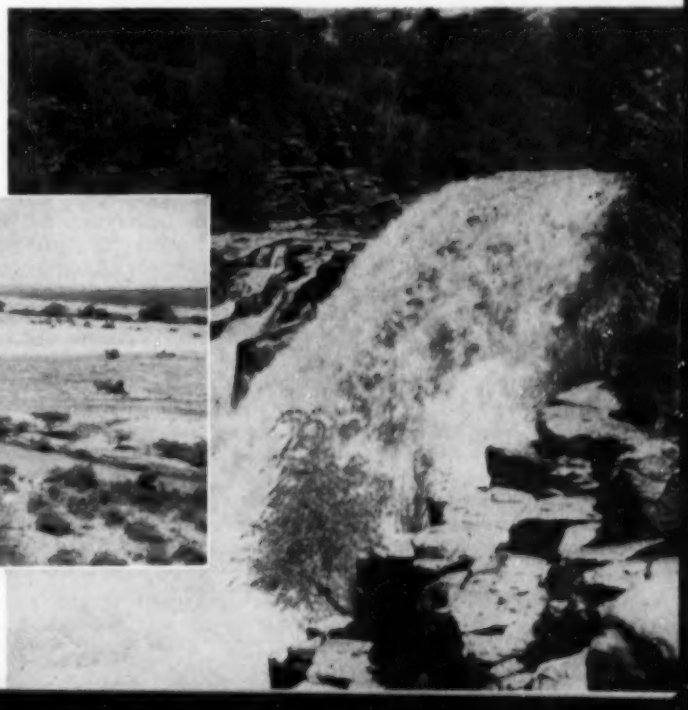
Navigation on the Nile River reaches into southwest Ethiopia by way of the White Nile and the Baro River. The possibility of extending this navigation deeper into the interior of Ethiopia and maintaining it during the dry season is another problem that awaits solution by water resources engineers.

Unexplored mineral wealth

Many of the secrets of Ethiopia's mineral wealth still lie hidden in her hills and mountains. Modern processes are now being used in extracting gold at two places. That is not enough because practically every stream in the western part of the country is gold bearing, and production should be greatly increased. There is also platinum which has been mined for some time in a limited way. Potash, salt, and sulphur are present in several places. Limited mining operations have been carried on for these and for mica, asbestos, vermiculite, and other deposits, but the exploration stage cannot be said to have been really entered.

Even the town planners and utility engineers have their quota of projects in Ethiopia. A survey for a complete new city at the southern end of Lake Tana has recently been made, and specific improvements in many other cities have been planned. Addis Ababa has recently been conspicuously improved by the creation of wide avenues through the city and by the building of durable and attractive walls and structures to line these new thoroughfares. But the capital city is not content to improve its appearance only. Its water supply and sanitation are now under scrutiny and will pose serious problems for engineers to solve.

Reservoir site (below) on Awash River at Koka, 50 miles southeast of Addis Ababa, is under study for development to supply power to capital. Here dam 85 ft high will create one million acre-ft reservoir. Awash River falls comprise series of short drops. That shown at right, near site of proposed dam, is about 30 ft high. Waterfalls are plentiful in Ethiopia but reservoir sites as good as Koka are not so easy to find.



Experimental filters for treating cellulose acetate wastes

Within the past few years we have seen a spectacular growth of the synthetic fiber industry. The number of new synthetic yarns produced is increasing steadily because of the rapid expansion of the petrochemical industry which produces the necessary chemicals in commercial quantities for the production of Nylon, Dacron, Orlon, Dynel, Acrilan, Vicara, etc. In view of the vast strides and accomplishments to date, it is reasonable to expect that other fibers and yarns will emerge from the experimental stage to production levels in the not too distant future. The resulting waste problems will impose a challenge that must be met by those who assume responsibility for industrial waste treatment.

When we realize that the textile production and processing industries now consume 25 percent of all the industrial chemicals produced in this country and that a 43 percent increase in capacity is predicted within the next two years, the current problems, as well as those in the embryonic stage are such that the dissemination of information regarding their solution is essential. In addition to the new synthetic yarns and fibers, it is necessary to consider the semi-synthetic textiles—cellulose acetate and viscose yarns—which, because of their production levels, offer a challenge of their own.

Textile fibers may be classified in several ways, the most reasonable being natural and man-made. The literature is replete with methods and procedures for treating natural fiber wastes. Not so with the wastes from synthetic fibers. The man-made fibers are produced from cellulose, proteins, and the polymerization and co-polymerization of chemicals which result in the true synthetic fibers.

A wet-process industry

In the manufacture of acetate yarn, seven major materials are necessary—purified cellulose from cotton linters or wood pulp, galacial acetic acid, acetic-anhydride, sulphuric acid, acetone, and water. The approximate quantities of materials required per pound of cellulose acetate fiber or yarn are listed below:

Raw material	Lb per lb fiber or yarn
Purified cellulose	0.65
Acetic anhydride	1.60
Galacial acetic acid	4.00
Sulphuric acid	0.05
Acetone	3.00
Water	83.30

From the foregoing it is evident that cellulose acetate production is a wet-process industry. It requires more than 9 lb of raw materials per pound of yarn produced. With production for the past three years averaging more than 350 million lb per year, the tremendous amount of chemicals required is obvious.

Subsequent to World War II, Celanese like many major industries, was in the throes of a large expansion program. Management, cognizant of the trend in pollution abatement, established technical services to help the plants in waste evaluation. Changes in plant processes were studied and, in some instances, with very beneficial results. In one instance a modernization program resulted in a 30-percent B.O.D. reduction even though production had increased by approximately 7 percent. It is not always possible, however, to reduce loads sufficiently by process and equipment changes to eliminate the need for treatment. Plant location frequently makes treatment inevitable. Industrial sites established 25 years ago were selected without realizing that the discharge of pollutants would some day create a costly problem.

Cellulose acetate can be prepared by several acetylation methods. During the process the acetate is formed by replacement of the hydroxyl group of the cellulose by the acetate radical. Substitution becomes complete after 7 or 8 hours. The time may vary depending on the degree of polymerization required. To insure completion of the reaction within the time specified, it is necessary to subject the cellulose to pretreatment with a mixture of acetic and sulphuric acids. During acetylation the cellulose loses its fiber structure and gradually changes into thick viscous paste. This paste is poured into dilute acetic acid, which precipitates the acetate in the form of a white flake.

Under these conditions the flake retains an appreciable amount of acetic acid. For this reason considerable washing is necessary. Much attention is given to it since the cost of recovery increases rapidly with increased dilution. After the flake is washed and dried, it is dissolved in acetone. The resulting liquid, known as dope, is filtered and extruded in spinning machines where the acetate yarn is formed. The filament yarn is given a finish application and bobbin wound.

Cellulose acetate wastes

The principal wastes originate in the process from the recovery of acetic acid and the manufacture of acetic anhydride rather than the actual manufacture of the cellulose acetate. The acid recovery process is well known and follows the line of extracting weak acid with an organic ester followed by the recovery of 100-percent acid and ester by separate distillation processes. The greater percentage of the sewered waste is continuous and contains small amounts of unrecoverable acetic acid, acetate, cellulose acetate fines, and sugars from hydrolysis.

As in the case of acid recovery, recovery of the solvent is essential to the economics of the process. The acetone given off from the extruded yarn in the spinning machines is conveyed by ducting to the solvent recovery system, where it is purified and reused. Some solvent is naturally lost via still bottoms and some is absorbed by the air-conditioning system and blown down into the sewers. The amount is small and its polluting effects are not great.

A typical analysis of the waste is:

B.O.D.	2,700–3,900 ppm
Dissolved oxygen	0
pH	3.5–4.3
Total solids	9,700–13,200 ppm
Suspended solids	76–111 ppm
Sulphates	7,500–9,000 ppm
Volatile acids	1,900–2,800 ppm
Temperature	105 deg F

L. W. ROZNOY, Technical Consultant, Celanese Corporation of America, Charlotte, N. C.

yield encouraging results

The initial approach to the solution of the problem was on a laboratory scale. It was hoped that sufficient data could be gathered to allow for further investigation at pilot-plant level. A program was set up by the engineering department to study the effect of aerobic and anaerobic biological treatment methods. Both conventional and high-rate trickling filters were set up, in single and multiple stages, while digesters were set up to determine the feasibility of methane fermentation. Routine laboratory supervision and analytical determinations were performed by the plant production department and the main laboratory personnel.

Anaerobic digestion

The problem was investigated initially by setting up digesters for anaerobic digestion. Existing technical literature did cite several instances of successful application of methane fermentation on wastes with B.O.D.'s similar to ours. Buswell reported some success with a synthetic waste containing acetic acid and sodium sulphate. It was found that concentrations of sodium sulfate as high as 10,000 ppm could be tolerated in the mesophilic fermentation of acetic acid. With this information a three-phase program was established to determine:

1. The required minimum ratio of seed sludge to waste
2. The detention period required for maximum B.O.D. reduction
3. The effectiveness of the treatment on a continuous-feed basis

In determining the minimum ratio of waste to feed sludge required for digestion, seven digesters were set up, incubated in a 37-deg C oven with water traps for measuring gas production. The digesters were set up to contain 1, 2, 5, 10, 25, and 40 percent of seed by volume. The pH of the sample was adjusted to 7.0 and fortified with nitrogen and phosphorous in the normal B.O.D., nitrogen, and phosphorus ratios. After 5-day incubation, the supernatant liquor was analyzed for B.O.D., volatile acids, pH, hydrogen sulphide, sulphates, and alkalinity. The digesters were set up in duplicate using partially digested activated sludge (from Hagerstown, Md.) and partially digested trickling-filter sludge (from Ridgewood, N.J.) for seed.

The New Jersey sludge indicated that a minimum of 5 percent of seed sludge would be required to obtain an appreciable B.O.D. reduction (Fig. 1). The Hagerstown sludge indicated that a minimum of 10 percent of seed would be required. The test was rerun at 30 deg C using a water bath of constant temperature (Fig. 2). The digesters were sealed with wax and submerged in water, that is, a half inch of water was maintained over the top of the digesters. In the first three days 75 percent of the gas formed was collected. Of this, approximately 50 percent was collected the first day. The minimum seed-to-waste ratio that we could consider feasible was 10 percent with the Ridgewood sludge and 25 percent with the Hagerstown sludge.

With incubation at 37 deg C, greater B.O.D. reductions were obtained in every case except one. The use of the New Jersey sludge gave a greater B.O.D. reduction and produced more gas than the Hagerstown sludge. This may have been due to the fact that it contained approximately twice as much total and volatile solids. The ratio of the volatile to total solids in each instance however was similar. The sludges had the following composition:

Constituents	Ridgewood sludge	Hagerstown sludge
pH	7.0	7.3
Total solids	4.41	2.29
Volatile solids	2.79	1.48
M.O. alkalinity	1,350	2,940
Volatile acids	2,145	2,540
Volatile solids to total solids	0.63	0.64

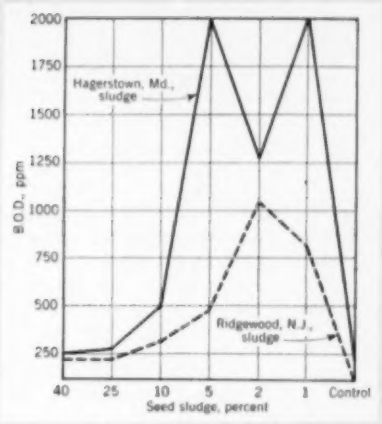


FIG. 1. Results with sludge from Ridgewood, N. J., indicated that minimum of 5 percent of seed sludge would be required to obtain appreciable B. O. D. reduction. Graph shows B.O.D. reduction in cellulose acetate waste digested at 37 deg C for various percentages of seed sludge.

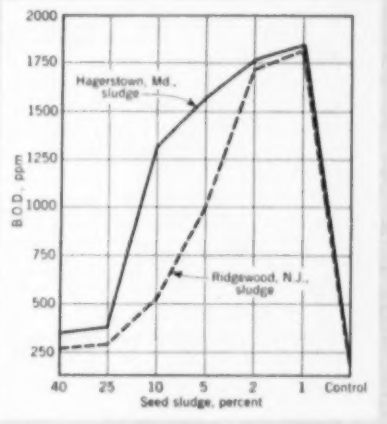


FIG. 2. Graph shows poorer results obtained when test recorded in Fig. 1 was rerun at 30 deg C. At this temperature, at least 10 percent seed sludge was required with Ridgewood sludge, and 25 percent with Hagerstown sludge.

In determining the detention period required for maximum B.O.D. reduction, three portions of wastes were prepared to give 2, 5, and 10 percent seed by volume. Each was corrected for pH, and supplemented with nitrogen and phosphorus. Seven 400-milliliter portions of each of the three admixtures were placed in 16-oz bottles, sealed and placed in a water bath at 37 deg C. One digester was removed daily for seven consecutive days and the supernatant decanted. One half of the supernatant was immediately analyzed for B.O.D., pH, and volatile acids, while the other half was aerated for an hour.

B.O.D. reduction by anaerobic digestion under the conditions described was found most effective

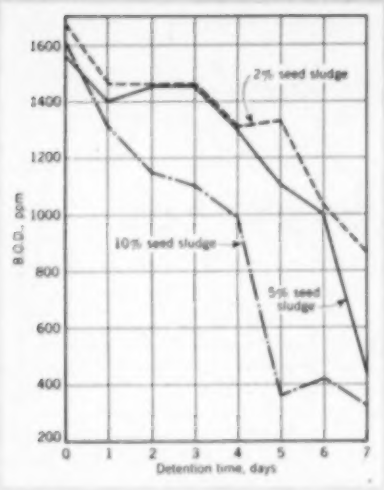


FIG. 3. Reduction of B.O.D. at 37 deg C was greatest using 10 percent seed sludge. Reduction was about 80 percent after 7 days, with significant reduction after 5-day incubation period.

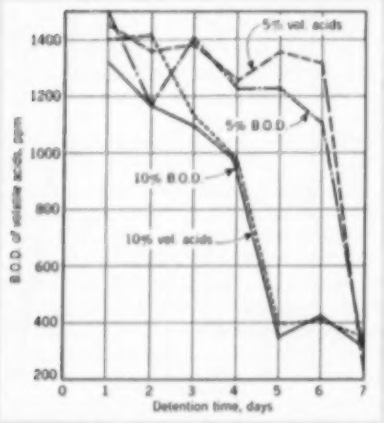


FIG. 4. Volatile acids were reduced in same order of magnitude as B.O.D. at temperature of 37 deg C. See Table I for test results.

FIG. 5. Comparative efficiencies of hydrolised and non-hydrolised waste were plotted, indicating that organic fraction attributed to hydrolysis was less easily oxidised.

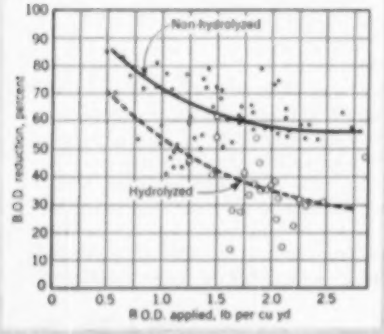


TABLE I. Effects of digestion and aeration on B.O.D., pH, and volatile acids in cellulose acetate waste with addition of 2, 5, and 10 percent of seed sludge

Effect on B.O.D.:

Days digested	Before aeration			After aeration		
	2%	5%	10%	2%	5%	10%
0	1,665 ppm	1,565 ppm	1,598 ppm	....	....	....
1	1,465	1,400	1,300	1,500 ppm	1,500 ppm	1,332 ppm
2	1,465	1,465	1,166	1,600	1,166	1,465
3	1,465	1,465	1,100	1,565	1,400	1,100
4	1,300	1,300	980	1,200	1,232	880
5	1,332	1,099	360	1,299	1,232	420
6	1,032	999	420	1,066	1,099	320
7	860	440	320	820	320	380

Effect on pH:

Days digested	Before aeration			After aeration		
	2%	5%	10%	2%	5%	10%
0	7.9	7.8	7.7	...	...	...
1	7.9	7.6	7.4	8.4	8.5	8.5
2	7.5	7.1	7.1	8.5	8.6	8.5
3	7.2	7.0	7.1	8.5	8.7	8.7
4	6.9	7.0	7.1	8.6	8.6	8.7
5	6.9	7.0	7.3	8.6	8.7	8.9
6	7.0	7.1	7.3	8.6	8.7	8.9
7	7.1	7.5	7.4	8.8	8.6	8.8

Effect on volatile acids:

Days digested	Volatile acid after aeration		
	2%	5%	10%
1	1,493 ppm	1,459 ppm	1,407 ppm
2	1,527	1,356	1,424
3	No result	1,390	1,133
4	1,6[illegible]0	1,253	978
5	1,287	1,356	395
6	1,253	1,321	412
7	858	240	360

when using a 10 percent concentration of seed. The reduction was approximately 80 percent after a 7-day digestion period (Fig. 3). The B.O.D. reduction with 5 and 2 percent seed varied directly with sludge concentration. The reductions were 72 and 48 percent respectively. The volatile acids were reduced in the same order of magnitude as B.O.D. (Fig. 4). As a result of the close correlation, we attempted to determine whether any relationship existed between the two. Although it appears that the efficiencies were tending to simulate each other after 7 days of digestion, the 10-percent seed mixture showed a significant difference at the end of the 5-day incubation period. The results of the test are tabulated in Table I.

Continuous digestion tried

In determining the effectiveness of treatment on a continuous-feed basis, a 5-gal, wide-mouth carboy was incubated in a constant-temperature bath and completely wax sealed. It was equipped with three stopper connections for loading, unloading, and gas removal. The material was removed by evacuating a vessel with a vacuum attached to the digester unloading line. Feed was supplied to the digester from a tank by the partial vacuum produced by the removal of the waste. The gas was measured by displacement of water in a calibrated container. The detention period selected was 9 days. This was considered to be equivalent to a 7-day detention under plant conditions. The seed was that used in the test previously described. The digester was charged with 2 liters of sludge and 2 liters of waste; 2 liters of waste were added for 9 consecutive days and on the ninth day 2 liters of waste were withdrawn before the raw feed was added.

The average B.O.D. reduction was approximately 49 percent for 51 days of continuous operation. It was observed that a 65–70 percent reduction was obtained when the B.O.D. of the influent was 4,000 ppm or greater. Gas production averaged 5.6 cu ft per lb of applied B.O.D. and the volatile acids increased to 2,700 ppm. Since the results did not measure up to our expectations, it was suspected that the high sulphate

(Vol. p. 290)

concentration was either retarding or inhibiting the digestion process.

An investigation was made to determine this effect by batch trials. A normal waste containing approximately 9,000 ppm of sulphates was incubated for 5 days. The B.O.D. was reduced from 3,600 to 2,700 ppm, a 25-percent reduction. On a duplicate sample from which the sulfates were precipitated with lime at pH 11.0 and readjusted with hydrochloric acid to pH 7.0, the B.O.D. was reduced to 700 ppm, an 80 percent reduction. It was decided to discontinue the digester trials and proceed with the trickling filter studies subsequent to this test because:

1. It was apparent that the sulfate concentration was exerting an undesirable effect.
2. Removal of the sulfate by precipitation with lime would be costly and tend to make such treatment uneconomical.
3. The average B.O.D. applied to the digester was only 0.023 lb per cu ft.

The aerobic treatment program was initiated by constructing two laboratory filters of stainless steel tubing of 6-in. diameter, packed with 1-in. earthenware saddles to a depth of 6 ft. The packing was supported by a $\frac{3}{4}$-in. mesh screen secured in place by a clamp around the tubing.

The filter was conditioned by adding 1 liter of seed sludge to 9 liters of waste, diluted to 50 gal with tap water. This mixture was recirculated for 7 days and continued for an additional 7 days by operating the filter with fresh feed which contained 10 percent of the filter effluent from the previous day's run. The filters were set up to operate simultaneously. Filter No. 1 was operated as a conventional low-rate filter, while filter No. 2 was started as a high-rate filter.

The raw waste was neutralized, placed in a vessel which held a 24-hour supply, pumped, and measured by rotometers. Effective distribution was obtained by allowing the waste to fall on a circular steel plate which was suspended approximately 3 in. above the surface of the packing. When recirculation was used, the filter effluent was collected in a second vessel, pumped, metered, and discharged to the filter.

During the operation of the filter, it was not uncommon to detect an odor of hydrogen sulfide. The effluent was turbid and had a color bearing from amber to dark green in contrast with the color of the feed, which was always light to medium amber.

The upper loading limit, which netted an appreciable reduction in B.O.D., was 1.6 lb per cu yd at a recycle ratio of 1½:1. The B.O.D. of the waste was reduced from 2,900 to 1,080 ppm, or 62.5 percent. When the recycle ratio was increased to 4:1, the net B.O.D. reduction decreased to 43.4 percent. When the filter was recycled at 6:1, the B.O.D. reduction was 52.2 percent. The applied load at this recycle was 2.06 lb per cu yd. In an endeavor to increase the efficiency of the unit, the plant air system was connected to the bottom of the filter. The results observed during the period of operation with forced air did not differ materially from those secured by operation without the air.

Observations from filter runs were such that when the hydrolyzed waste was a portion of the applied waste, a decrease in efficiency was noted. A graphical analysis, plotting the applied B.O.D. load against the B.O.D. reduction, showed some inconsistency. It did, however, reveal the differences in treatability of the hydrolyzed waste as opposed to the nonhydrolyzed waste (Fig. 5). It appeared that the organic fraction attributed to hydrolysis was less easily oxidized. Although the volatile acid reduction was a function of the B.O.D. destroyed, a sound relationship could not be established between the two. It was concluded that the oxygen consuming materials were supplemented by fractions other than acetic acid or its salts. It had been hoped that the volatile acid analysis would be sufficiently indicative of the effectiveness of the treatment since it would have permitted bypassing the time-consuming B.O.D. determination.

The optimum pH of the waste was indicated to be in the range of 5.5 to 6.5. When the pH of the raw waste was decreased to 6.0, a 20 percent increase in B.O.D. reduction was noted. The color of the effluent was improved and it acquired a greenish cast.

The results with filter No. 2 operating at a recirculation ratio of 18:1 netted a B.O.D. reduction of 52.8 percent at an applied load of 1.75 lb per cu yd. It was noted that the B.O.D. reduction at the higher recycle was practically identical with that obtained when the recycle was 6:1. When the load was doubled and the recirculation halved, the filter ponded seriously and frequently, and finally became septic. Hydrogen sulfide was strongly in evidence and the color of the effluent turned black. In general, it was noted that the effluent from filter No. 2 was darker in color, and both effluents were notably darker, when the hydrolyzed waste was being treated. The filter deteriorated rapidly and the B.O.D. efficiency dropped to 23 percent. The applied load in this instance was 4 lb per cu yd. Since the results from filters Nos. 1 and 2 did not reduce the waste to an acceptable value, the packing of filter No. 2 was cleaned and a two-stage series operation was started.

Two-stage filtering tried

The multi-stage operation was a combination of the No. 1 and No. 2 filters. The No. 1 filter served as the first stage and the No. 2 served as the second stage. The recycle of the first stage was supplied from the effluent of this stage and the recycle of the second stage was handled in a like manner. The filter was placed in service with an application rate of 0.68 million gal per acre per day at a recirculation rate of 4:1. The raw feed was enriched with nitrogen and phosphorus in ratios of B.O.D. to nitrogen and phosphorus of 20:1 and 40:1 respectively.

During the first three weeks of operation, the overall B.O.D. reduction averaged about 65 percent with a B.O.D. loading of 1.15 to 2.32 lb B.O.D. per cu yd per day. The B.O.D. of the effluent was between 700 and 1,200 ppm. Beginning the fourth week, the pH of the feed was lowered from 7.0 to 6.0. The immediate effect was a slight lowering of the filter efficiency. However, through the next three weeks the efficiency increased steadily until, during the last reported week of operation, it had reached 80 percent; the B.O.D. of the effluent was 500 ppm. This change took place without any effective change in the B.O.D. loading.

After combining the two filters, the effluent of the second stage was, in general, extremely turbid. It varied from a very turbid amber to a grey-white color, which might be compared to diluted and dirty milk. The effluent of the first stage ranged from slightly turbid with a green or amber color to very turbid green. The odor of the effluent from either stage was light, and the odor at the filter top was mild but not particularly pleasant.

The multi-stage series operation gave consistent results during the course of operation. In an endeavor to increase the efficiency, we added 5 percent of sanitary sewage to the raw waste. The addition of the

(*Continued on page 112*)

Barytes aggregate and grout intrusion method used in shield for materials testing reactor

LEWIS NARROW, MTR Project Engineer, Idaho Operations Office, U.S. Atomic Energy Commission, Idaho Falls, Idaho

Barytes aggregate and Intrusion grouting were combined to solve a number of unusual engineering problems in construction of the biological shield for the Materials Testing Reactor (MTR) at the U.S. Atomic Energy Commission's National Reactor Testing Station (NRTS) in Idaho.

Essentially, the problems were concerned with providing a radiation shield of minimum thickness for the protection of operating personnel, yet to allow for inclusion in the concrete shield of cooling water and service pipes and ducts, in addition to many experimental ports.

The MTR was conceived as a facility to provide an intense neutron flux (4×10^{14} thermal neutrons per sq centimeter per sec) in which to test various materials being considered for use in future reactors.

Basic design work was done by a joint committee representing the Argonne and Oak Ridge National Laboratories. The Blaw-Knox Construction Company was responsible for architect-engineering, and the Fluor Corporation was awarded the major construction contract. The Intrusion grouting was performed by the Prepakt Concrete Co. Design and construction were administered by the Idaho Operations Office of the AEC.

Previous biological shields were constructed of lead, steel, conventional concrete, and high-density concrete. The high-density concrete usually was made with a coarse aggregate of iron or steel punchings, which is subject to separation and segregation in handling. This aggregate was first specified for the MTR shielding.

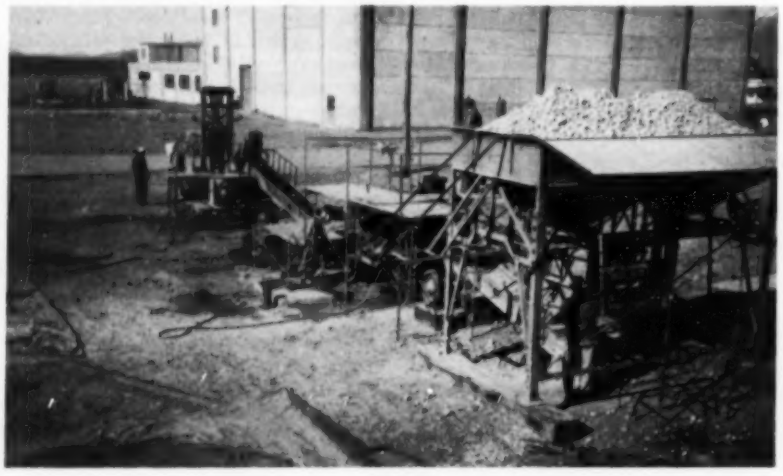
The Oak Ridge National Laboratory had however conducted tests on, and to a limited extent had used, a high-density concrete made with aggregate of natural heavy ores, and recommended that barytes (barium sulphate) concrete be used in the MTR shield. Tests had indicated that the use of barytes would permit construction of a shield only two-thirds as thick as one made of conventional concrete, in so far as ability to stop gamma rays was concerned. (An article on barytes aggregate concrete, by Edward G. Tirpak, appeared in CIVIL ENGINEERING for August 1951.)

Tests were conducted by the Bureau of Reclamation to determine means of obtaining a workable concrete of maximum density, and to test the behavior of the concrete under a variety of conditions.

These tests indicated that by proper selection of the grade of the barytes, a workable mix could be designed which would produce concrete with satisfactory shielding properties and a minimum density of 218 lb per cu ft by conventional placing, and 224 lb per cu ft by the Intrusion grouting method. The tests showed that poor resistance to weather and high losses of aggregate during processing could be expected. In all other respects, however, it was found that a satisfactory concrete could be obtained from barytes aggregate, and since the shielding would not be exposed to weathering, this material was used.

The MTR shield, as redesigned to use the natural heavy aggregates, consists of a hollow cube 32 × 32 ft, with walls about 9 ft thick. The upper portion of the cube is pierced by some 100 access holes, varying from 1 in. in diameter to 8 ft square. Many of these holes were set to tolerances measured in thousandths of an

System used in handling barytes aggregate for upper part of shield utilizes, right to left, equipment for grade proportioning, screening and washing, and loading into bucket on fork lift for transport to forms inside building.



Barytes aggregate used in Materials Testing Reactor Shield was carefully graded, and everything less than $^1/_2$ in. was discarded. Graded aggregate was recombined before placing in forms and only smaller sizes were used in restricted spaces.

inch. In addition to the access holes, the shield contains piping, duct work, and electrical and instrument lines.

The overall requirement for shielding concrete was approximately 1,000 cu yd, of which one-third—the lower part of the shield—was placed by conventional methods. Concrete for the upper two-thirds, which is full of inserts, was placed by Intrusion grouting.

Friable aggregate complicated concrete placing

Barytes aggregate was shipped from the mine after passing an 8-in. screen, and was processed at the NRTS (Idaho) into the various gradations required. The handling and processing were performed under a separate contract by the Morrison-Knudsen Company.

Aggregate material for the conventionally placed concrete was stockpiled near a central mixing plant approximately 4 miles from the MTR site. The mix specified for this concrete was quite similar to that using normal aggregate. Batches of 1 cu yd contained 486 lb of cement, 2,369 lb of barytes sand, 3,109 lb of aggregate ($1^1/_2$ to $^1/_4$ in.). The water-cement ratio was 0.67, and the slump varied from $2^1/_2$ to $4^1/_2$ in.

The concrete for the conventional pour was hauled to the MTR in transit-mix trucks after batching and mixing in the central plant. Batches of approximately half size were used because of the above-normal weight. Although the aggregate was quite friable, no great amount of breakup occurred when continuous mixing from plant to forms was employed.

Hoppers and tremies were used in placing the concrete inside the forms. Plugging in the discharge from the mixer trucks and at the hoppers was apparently due to segregation of the heavy aggregate in concrete handling. These difficulties were considerably reduced after the mix was adjusted to about a 4-in. slump. Two separate pours were made in placing the 335 cu yd in the lower third of the shield.

Steel forms used

First forms erected came just above the top of the conventionally placed concrete; the second step topped out the job. Steel plates, rigidly braced from the inside, were used for forms. When welding was permissible, the individual steel plates were sealed in that manner; otherwise they were bolted or keyed together.

Hand placing of small barytes aggregate was necessary in confined spaces around piping. Where more room was available, aggregate was placed by steel tremie.

Heavy barytes aggregate is seen in place up to top of reactor shield, with reinforcing, grout and vent pipes, and sounding well.

The upper section contained the difficult concrete-placing problems. After considering a number of possibilities, it was decided to place this part of the shield by the grout Intrusion method developed by the Prepakt Company.

This method consists of first placing the coarse aggregate in the forms and then filling the voids with an intruded cement grout containing an admixture supplied by Prepakt. To provide the desired density, aggregates were placed by hand in regions containing numbers of pipes and ducts. The Intrusion method permitted a final check, immediately before pumping the grout, on any imbedded items that might be subjected to displacement.

A test block was fabricated to simulate some of the conditions that would be encountered in the actual shield. Void studies were conducted with various sizes and proportions of coarse aggregate samples, and test cylinders were prepared and tested for determining the compressive strength of concrete made by the proposed method. These tests, conducted in February 1951, led to solutions to many of the problems anticipated.

Coarse aggregate placed dry

The coarse aggregate for the top part of the shield was stockpiled adjacent to the reactor building. The minimum size of coarse aggregate was $^1/_2$ in., and concrete with a minimum strength of 2,500 psi was specified for the material to be placed by the Intrusion method. Coarse aggregates were segregated into four sizes—5 in., 3 in., $1^1/_2$ in., and $^3/_4$ in.—and everything less than $^1/_2$ in. was discarded.

This graded aggregate was recombined before being placed in the forms, but only the smaller sizes were used in restricted spaces, where the aggregate was hand placed around the imbedded items. There was no requirement for close grading of this material. The important consideration was the percentage of voids before grouting, specified to be 33 to 40 percent.

The fine aggregate in the Intrusion grout passed the No. 30 screen, the larger sizes being eliminated for better pumpability. Because of the fineness of this material it was stored indoors, and was sacked before being moved to the job site.

After the coarse aggregate had been recombined in a portable batching plant, it was rewashed over a $^1/_2$-in. screen, and then carried by a belt conveyor into 1-cu yd concrete buckets. These were transported by fork-lift trucks into the reactor building, and the aggregate was delivered into the forms through hoppers and tremies by an overhead crane previously installed as part of the permanent equipment.

Canvas tremies were used at first in an attempt to prevent breakage, but they were difficult to maneuver quickly, and canvas failed to stand up, causing aggregate breakage. Six-inch metal tremies, which were substituted, worked out quite satisfactorily, although it was necessary to move the discharge continuously during placement to prevent breakage. Placement of the 1,292 tons of coarse aggregate took five days (November 6–10, 1951).

Grout pipes, of $^3/_4$-in. diameter and with beveled ends, were inserted in the aggregate as placing started, and were extended above the top surface. Grout pipes curving under obstructions were coupled immediately above the elbow so that the straight section, together with all the entirely straight grout pipes, might be pulled as grouting progressed.

Vent pipes, also of $^3/_4$-in. diameter, were coupled in a similar manner. Sounding wells, consisting of 2-in. pipes, slotted throughout their length, also were provided to check the grout level during pumping, but these remained in the pour. Altogether, approximately 150 pipes were placed.

To keep a continuous record of the height of the pour, pipes were identified and drawn on a location chart, and throughout the grouting operation entries were made of the soundings taken in the wells.

The grout used to intrude the coarse aggregate mass contained one part of Type II portland cement and $1^1/_3$ parts of barytes sand, proportioned by weight. Intrusion Aid was added to the amount of 1 percent of the weight of the cement. The water content was 0.55.

The grout mixing equipment was furnished by the Prepakt Concrete Company and consisted of a gasoline-powered, horizontal-type paddle mixer of approximately 7-cu ft capacity. The mixer discharged through a rotary screen into a horizontal agitator which was connected to three Simplex pumps. This equipment was set up immediately outside the reactor building. The discharge lines from the pumps were led into the building and to the top of the reactor through approximately 150 ft of 1-in. hose and pipe. These lines were tied together near the reactor top, so that pumping could proceed from any of the pumps as desired.

It had been intended to place about 1 ft of water inside the forms to keep the aggregate thoroughly wet as the grouting proceeded, but this idea was abandoned because of the time and expense involved in getting steel forms sufficiently tight. Grouting was started rather slowly at 10 a.m. November 13, and gradually increased to a maximum rate which would raise the grout level 1 ft per hour. This rate was reduced to $^1/_2$ ft per hour after a height of $2^1/_2$ ft had been reached, because of leakage from the lower part of the forms. This rate was continued except for minor interruptions until the entire pour was completed. The most serious interruptions were caused by mechanical failure of the mixing plant and by plugged pipes and housing. No difficulty was encountered in starting up equipment after any of these interruptions.

Topping off was done by using short inserts with beveled ends, which were worked into the surface aggregate until they contacted the upper surface of the grout.

Original plans called for a top form to prevent flotation, as well as to level off the upper face, but tests indicated this to be unnecessary because, with a heavy aggregate, no flotation would be expected. The top of the intruded concrete was kept approximately 6 in. below the required elevation.

Grouting was stopped at this point, at 9 p.m. on November 15, after a 56-hour period in which 5,865 cu ft of grout was placed. The following morning the surface was cleaned of excess grout by air and water jets, and a surface coat of conventional concrete was placed over the pour.

Cost record kept

A complete record of costs was kept for possible use in future designs. The aggregate as received at the site cost $19.69 per ton, and the processing, stockpiling, and loss brought the total cost to $31.61. Of this, $9.71 per ton represented freight costs. The overall cost of the concrete in the forms was $193.25 for that conventionally placed, compared with $188.41 per cu yd for the Intrusion grouted concrete.

On completion of the reactor, and its subsequent operation, a comprehensive survey of the radiation integrity of the shield was made by the operating contractor, Phillips Petroleum Company. Those making the survey noted that in general the bulk shield showed no radiation leaks attributable to faulty construction.

Above:
Workmen load horizontal-type paddle mixer for Intrusion grout. Mix includes Type II cement, minus 30 sand, and Intrusion Aid for fluidity.

Right:
Mixer (seen at back with skip up) discharges grout through rotary screen into horizontal agitator connected to three Simplex pumps (two seen in foreground) which move grout to reactor shield through 1-in. hose.

Conclusions

Following the construction and operational experience, these generalizations can be made regarding the construction methods:

1. Concrete made with heavy natural aggregate provides a satisfactory and reasonably economical biological shield.

2. The grout Intrusion method offers advantages in placing heavy-aggregate concrete in complicated forms containing numerous imbedded items, which must be set to close tolerances.

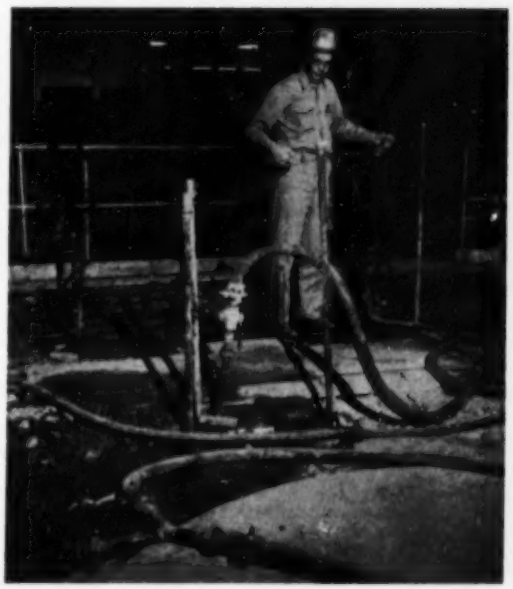
3. Barytes aggregate processing costs are high, because of screening specifications and the friable nature of the ore. The rock should be handled by scoops or buckets, not bulldozers.

4. Slump should be specified as 4 in., plus or minus 1 in., to facilitate handling and placement of concrete.

5. Great care should be used in sealing openings in formed surfaces and imbedded items, to prevent leakage of water or grout when using the Intrusion method. In this respect, steel forms are more difficult to seal than wooden forms.

6. The number of grout pipes should be held to a minimum.

7. An 8- or 10-in. steel tremie should be used in placing aggregate. Heavy belting can be used as baffles in the tremies, and as cushions in buckets and hoppers to reduce breakage.



Right:
Sounding is taken in sounding well (in front of man's right foot) to determine depth to which grout has risen during pouring of reactor shield. Note valve and coupling to grout pipe, and Y-branch on grout hose in foreground.

Below:
View of top of reactor shield during grout pumping operations shows grout lines, tops of vent pipes, and sounding wells.

Competitive bidding for professional services not in the public interest

Nor required by law, courts hold

WILLIAM N. CAREY, M. ASCE, Executive Secretary, ASCE, New York, N. Y.

Recent actions by the commissioners of the highway departments in at least two of our states have served to put an important question squarely up to the engineering profession—at least to its civil engineering segment. The question appears to me to resolve itself into whether civil engineer consultants, and civil engineer state and local officials, should abandon their long-held contention that engineering is a profession.

Two state highway departments recently have invited competitive bids from engineers for the furnishing of professional engineering services on certain state highway projects. In each case it was provided that sealed bids or proposals would be received up to a certain date, then opened and reviewed.

Either a bid form or a form of a final contract was furnished by the state, and each engineer was invited to insert in the form his price for furnishing the services outlined. In each case the usual escape clause, generally of no practical effect unless all bids are rejected, was included. It is that the owner reserves the "right to reject any or all bids." It is on this slender thread that some public officials and some engineers base a contention that bids or proposals received are not necessarily judged on a price basis, and therefore, that the procedure does not violate the ASCE Code of Ethics.

Both engineers and public officials know full well that the only purpose of receiving sealed proposals or bids of the kind here discussed is to facilitate a decision based on price, no matter what pious denials may be made. There have been occasions where public officials, even attorneys for public bodies, have been under the misunderstanding that their public works laws or ordinances compel competitive bidding on all contracts concerned with public works. A typical clause in public works laws follows:

> "Every contract or purchase made by the State Highway Department which contemplates the expenditure of more than $1,000.00, shall be let and made after being advertised under rules and regulations to be made and published by the Department."

Under the clause above quoted or some similar provision, public officials sometimes feel they must obtain competitive bids for professional engineering services. Oddly enough, if outside legal consultation is required by these same public officials connected with the same public works project, one never hears that they attempt to engage such consulting legal services through competitive bidding practices. They recognize the law as a profession and they conform to proper professional procedures. They seem unaware that engineering also is a profession. The courts, however, have clearly held that it is.

Not required by law

A good example of how the courts look at competitive bidding safeguards in public works laws and ordinances when professional services are concerned is indicated in an opinion by the Supreme Court of the State of California in the case of Clyde C. Kennedy vs Harry D. Ross, Controller of the City and County of San Francisco. The opinion is identified as "S.F. No. 17,298." In the San Francisco case it was alleged that certain engineering services for the city should have been contracted for after receipt of competitive bids because of the city ordinance requiring competitive bids for things and services costing over a certain sum.

The city engineer's office engaged the engineer under proper professional procedures but the controller refused payment on the grounds that the city ordinance had not been followed. The controversy was carried to the Supreme Court of the State of California. Some of the pertinent phrases in the opinion handed down are quoted below.

While pointing out that the City Charter went to great pains to require that contracts for the *construction* of public works should be subject to competitive bidding, the Court noted that it "does not follow that strict compliance with that requirement must be maintained in procuring expert services to furnish plans and specifications for the construction."

In citing the decision on another case (Los Angeles Dredging Co. vs Long Beach, supra 210 Cal.), the same California Supreme Court stated that "it was recognized that there are exceptions to the requirement

that contracts must be let under competitive bidding." The Court further cited a quotation from *McQuillin on Municipal Corporations*, Vol. 2,

"Provisions as to competitive bidding have been held *not* to apply to contracts for personal services depending upon the peculiar skill or ability of the individual, such as the services of . . . an attorney at law, a superintendent or architect . . . or a consulting and supervising engineer, and generally the requirement does not apply to the employment of a professional man, in which case the authorities have a discretion as to his qualifications."

The California Supreme Court in this same case very aptly cited another case in point, Miller vs Boyle, supra (43 Cal. App. 39), as follows:

An architect is an artist. His work requires taste, skill, and technical learning and ability of a rare kind. Advertising might bring many bids, but it is beyond peradventure that the lowest bidder might be the least capable and most inexperienced, and absolutely unacceptable. As well advertise for a lawyer, or civil engineer for the city, and intrust its vast affairs and important interests to the one who would work for the least money."

The Court also pointed out that "The employment of a person who is highly and technically skilled in his science or profession is one which may properly be made without competitive bidding." As might be expected, in the Kennedy vs Ross case, the Court directed the controller to pay the engineer's bill on the ground that the engineer had been engaged in a legal and proper manner.

In many other cases other courts have ruled on this question. For example, there follows part of a report relating to the decision by the Appelate Court of the State of Virginia in the case of the City of Newport News vs Potter (58 CCA 483—1903):

"This case affirms decision of the circuit court for the eastern district of Virginia. Alexander Potter of New York was engaged as consulting engineer to supervise sewer construction. (This firm also designed the sewer). His fee was 6½% of the cost. The contractor abandoned the job and engineering services were continued. Potter sued to recover for services. City claimed it could not render itself liable on such an implied contract; relying principally on the clause of the City Charter providing 'All contracts for erection and construction of public improvements shall be let to the lowest responsible bidder . . . .' The court stated 'It seems to us that the services of a consulting and supervising engineer are in the same category as those of a legal adviser.' . . . . 'The provision has no application to the employment of an engineer to supervise the work.' "

The decision on Potts vs City of Utica (86 Fed. 2nd 616), in the State of New York is another in point. Clyde Potts, an engineer, was retained on a contract to investigate the water company's rates. The court held that the statute requiring competitive bidding was "inapplicable to a contract for professional services . . . where value of services depends on skill with which they are performed."

A Texas case involving engineers and architects has direct bearing, Gulf Bitulithic vs Nueces County (11 SW 2nd 309—1929). Here the court said,

"Our courts have repeatedly recognized that contracts of the nature involved in this case, involving special skill and experience, were not within the contemplation of the statute as to competitive bids. It would be ludicrous indeed if a county should publish to the world that it desired to let the lowest bidder a contract to supervise the building of an elaborate road system involving the expenditure of $2 million . . . . In the very nature of things, the legislature in passing this statute did not contemplate that services of this kind covered by the contract in question should be subject to competitive bids."

Not in the public interest

Other Texas cases noted are Stephens vs McCammon—1931 (40 SW 2nd 71), and Stephens vs McCammon—1932 (52 SW Sec 56) (Texas Supreme Court). Here the court said,

"To hold that contracts for this kind of work must be let to the lowest bidder would inevitably result in the county being placed in a position which would require it to accept the services of incompetent persons. Naturally one who has no skill, experience or technical knowledge could under-bid one who possesses the skill, experience or technical knowledge to perform this kind of service. In other words to construe the statute contended for would place a premium upon incompetency and produce an unfortunate situation. To illustrate, could it be seriously intended that, if a county desired the services of a skilled and competent attorney to represent the county in some important piece of litigation involving a large sum of money, that the county should, before letting the contract, submit it to competitive bids and then be required to hire the person making the lowest bid therefor? . . . . It is plain the legislature never intended that such services should be awarded upon competitive bids."

In Massachusetts, Rollins vs City of Salem (146 NE 795—1925), the city charter required competitive bidding for construction work except in an emergency. It was here held that this provision did not apply to the employment of a consulting engineer, since his was not a contract for construction. A consulting engineer was here employed to determine the feasibility of building a satisfactory school addition for a stated sum. Construction was one thing but the service of the consulting engineer requiring professional skill and judgment was something quite different.

One of the clearest pronouncements on the question was made by a Pennsylvania court in the case of Stratton vs Allegheny County (245 Pa. St 519—1914). In this case the law provided that all contracts should be let to the lowest responsible bidder after reasonable notice. The court said,

"It has never been held, as far as we have been able to ascertain, that the above provisions apply in the making of contracts for the employment of attorneys, physicians, engineers and others involving professional skill."

Reference is also made in this case to Dillon on *Municipal Corporations*, section 1203:

"Scientific knowledge or professional skill has also been regarded as furnishing an exception to the statutory rule. Thus it has been said that the services of a lawyer, of a physician, or of an architect or a surveyor are not embraced within the provision requiring the letting of contracts to the lowest bidder."

A basic concept which runs through many of these and other similar court decisions on this subject is the self-evident fact that it is impossible to obtain truly competitive bids for a service under conditions where the bidders obviously would be bidding on furnishing differing services. Stated another way, unless a definite specification can be written to cover a thing or a service, truly competitive bids cannot be obtained on that thing or service. No man has or ever can write a specification to cover the quality of professional thought or the technical skill and judgment required to assure the success of a surgical operation, the trial of a lawsuit, or the design of an engineering project.

It is true that engineers with questionable professional standards might bid on furnishing the design, plans and specifications for a bridge of a certain length or for similar services covering, say, fifty miles of superhighway. The bids would be based on outlines of the end result desired. Such project outlines, however, no matter how they may be dressed up with details, do not and cannot constitute a specification against which competitive bids can be compared on any other basis than bid price.

It is hard to realize that any public official possessing sufficient intelli-

gence and ability to be elected or appointed could be so naive as to believe it could possibly be in the public interest to make contracts for professional services on the basis of competitive bidding. As stated in the Miller vs Boyle California case, "it is beyond peradventure that the lowest bidder might be the least capable and most inexperienced." Or, as in Stephens vs McCammon, where the Texas Supreme Court stated, "to construe the statute contended for (competitive bidding for a professional service contract) would place a premium upon incompetency."

It should be clear that the best engineering service obtainable on an engineering project assures the public of the best results. "Best results" means the best design and construction for the purpose at the least cost. The cost of the engineering service for a project is a very small part of its total cost, perhaps but 4 to 8 percent of the total. The difference between the cost of construction of a project which is even tinged with bad design or unsound engineering judgment and the contract price for constructing a well designed project can easily amount to several times the engineering fee. Cheap design always means high construction costs.

There are unscrupulous men in the engineering profession as there are in medicine and in law. Our professional licensing laws only partly protect the public from these shoddy characters. Professional codes of ethics in these fields and the manner in which the practitioners of these professions conform or fail to conform to these codes usually serve to set the truly professional men apart from the unethical. In the Code of Ethics of the American Society of Civil Engineers, it is stated that "It shall be considered unprofessional and inconsistent with honorable and dignified bearing for any member of the American Society of Civil Engineers . . . to participate in competitive bidding on a price basis to procure a professional engagement." This clause does not purport to prohibit competition among engineers nor is there any intent or attempt in our sister professions to prohibit competition among lawyers or doctors. All clearly prohibit competition on a *price* basis, and properly so in the public interest, as has been indicated. Any member of ASCE convicted of violating its Code of Ethics is subject to discipline, even expulsion from the Society, a very serious matter to any truly professional man.

Negotiate with qualified engineers

Competitive bidding is not the way to obtain engineering services. It is practically never adopted by industry, and when adopted by any agency of government, it is usually through ignorance on the part of the governmental unit concerned. The Federal Government is the largest single spender of money for public works, and the Congress is ever alert to provide laws to safeguard the expenditure of public works funds. The Defense Department probably spends most of the federal funds. Regulations of the Defense Department provide that engineering and architectural services shall be procured by negotiation—not through any attempt at competitive bidding. The basic clause in this regulation follows:

"The selection of architectural and engineering firms for the preparation of plans and specifications for public works or for other similar technical and professional services, such as master planning, engineering studies, and investigations, will not be based upon competitive bidding procedures but solely upon the professional qualifications necessary for the satisfactory performance of the services required."

This same principle is followed by the Atomic Energy Commission, the Department of the Interior and its Bureau of Reclamation. The General Services Administration which supervises many other public contracts for the government adheres to this same principle as do most other units of government, state and local.

The detailed procedure recommended by ASCE through which any client should engage professional engineering services is set forth on page 5 of the ASCE Manual of Professional Practice, Manual No. 29. For ready reference, this recommended procedure is quoted below:

"1. From a list of engineers recommended by qualified sources such as other employers or engineering societies, select one or more engineers to be interviewed.

"2. Determine which one of the engineers interviewed is best qualified for the particular engagement under consideration.

"3. Negotiate with the engineers so selected for services of the nature and extent required.

"4. The reasonableness of fees to be charged may be checked with sources of the lists considered under '1' above.

"5. Engagements involving preliminary investigation and reports should commit the engineer to limiting fees in case additional engineering services are required at a later date on the same project."

This is a clear-cut statement of how negotiation should be carried out. Obviously, if the client and the engineer cannot negotiate an agreement as to factors of time, personnel, price or for any other reason, the attempt will be abandoned and the client will negotiate with another qualified engineer. It is not intended or implied that ASCE recommends that it is in the public interest that the factor of price be *neglected* in such negotiations. It is to be emphasized, however, that the cost of engineering service is but one factor, and a minor one, in the total cost of the project involved. Qualifications other than direct cost of engineering should carry most of the weight in negotiations for professional services.

Points against competitive bidding summarized

The procurement of professional engineering services for public work through negotiation, rather than by attempting competitive bidding procedures, has been pronounced by the courts as being in accordance with our laws. The courts have gone farther and have pointed out that attempts by public agencies to obtain professional services through competitive bidding are not in the public interest. The principal agencies of the Federal Government through which billions of public funds are expended on public works every year, procure professional services through negotiation. State and local governments follow federal practice with rare exceptions.

So-called professional engineering services by licensed engineers sometimes can be procured through competitive bidding. In the rare cases where this practice is resorted to, trouble usually follows. High construction costs follow cheap design—always. In spite of high construction costs, cheap design and its natural companion, bad engineering judgment, may well result in project failure after construction.

Professional codes of ethics exist for two main reasons. One is to furnish a way to warn the public from involvement with professional sharpers or worse. The other is to state fundamental principles of ethics and practice for the conduct of individuals within the profession. The ASCE Code of Ethics prohibits competition *on a price basis*. Public works laws and ordinances do not require competitive bidding on professional service engagements. Public interest is served best when needed professional services are secured through negotiation with qualified professional people who conduct themselves in accordance with their accepted codes of ethics and practice.

Inadequate pre-college training imperils nation's future

S. D. STURGIS, JR., Major General, U.S. Army; Chief of Engineers, Washington, D.C.

A source of grave concern to those charged with America's defense today is the growing shortage of real engineering talent. Not only is our defense effort jeopardized by this shortage, but the forward momentum of American civilization may be brought to a standstill unless our engineering force is increased. Today, this force is dangerously lacking in both quantity and quality.

The basic reasons for this situation are not to be found in our system of engineering schools. They are fine institutions, fully capable of turning out the desired end product in the required numbers. But how can they teach college-level engineering and scientific subjects to classes of which only 66 percent can correctly multiply $2^1/_2$ by $3^1/_2$, of which only 68 percent can express $^3/_{20}$ as a decimal, of which only 81 percent can divide 7,642.38 by 1,000? Yet these were the results of tests recently given to a freshman class at one of our leading universities.

What else could be expected, though, when during the school year of 1948–1949, of all the public high school students in the United States, the percentages enrolled in the various courses showed only 15.1 enrolled in elementary algebra, 5.4 in intermediate algebra, 8.7 in plane geometry, 1.4 in solid geometry, 1.5 in trigonometry, 5.9 in chemistry, and 4.0 in physics? And these low enrollment rates are certainly not due to any lack of need for instruction at the high school level, for in a study of 200,000 eighth graders, only 6 percent could find 2.1 percent of 60.

As the influx of qualified students falls off, our engineering institutions are faced with the unhappy choice of reducing their output or lowering their standards. Either of these alternatives could be disastrous to the United States, for in Russia today the authorities are not much interested in so-called "happy, well-adjusted children." They want scientists and engineers who can develop and produce more effective means of waging war. We want scientists and engineers who can create and produce in peace, and we believe that the supreme happiness and the best adjustment to life are to be found in the towering realm of creation founded on hard work. But at the same time we need scientists and engineers for the defense of our civilization.

We have every reason to believe that the Russians are making great strides in professional education. Between 1940 and 1950 the number of trained Russian engineers increased 43 percent to a total in 1950 of about 460,000 engineers. By way of contrast, there were an estimated 400,000 American engineers in 1950. But the contrast does not end there, for the Russian engineering effort is committed exclusively to increasing the Soviet war potential, while ours is devoted primarily to maintaining and improving our high standard of living.

In the Russian ten-year schools, which are the equivalent of our secondary schools, half the curriculum is devoted to scientific and technical subjects, and one-third of all Russian students receiving a higher education are studying to be engineers. Although in 1950 the number of American university students was more than double that in Russia (2,116,000 in the United States to 916,000 in Russia), their engineering school enrollment was half again as large as ours (266,806 in Russia to 180,262 in the United States). Quantitatively, at least, they are leaving us behind, and from all that we know and see of their work, its quality is improving and may soon compare favorably with ours.

The full implications of the increase in Russian engineering potential as compared to our own have scarcely begun to be felt, but unless we reverse the present trend our country is in real danger. For in this technological age in which we live, we are, for the first time in our history, threatened by a power possessed of greater natural resources and greater manpower than our own. At present, the balance of peace and security is maintained only by our superior technology, which enables us to make better use of our limited resources to the point where attacking the United States is sheer folly. But as the gap between the American and the Russian technologies closes, this fine balance will become increasingly precarious.

We make much of the fact that it takes 10 years of engineering effort to bring a new plane off the drawing boards, 5 years to develop a new tank, and 2 years to design a power plant. But who ever stops to think about the 16 years of formal education that go into the making of the American engineers to whom we look for the accomplishment of these tasks? We cannot continue to look entirely to the old hands in the profession, for it is an inescapable fact that although age develops judgment and wisdom, truly creative thinking and new ideas usually spring from young minds. If we are to survive as individuals, as a profession, and as a nation, we must look to our youth and we must get the cream of that youth actively interested and participating in the several fields of engineering.

Today American engineering education stands at the crossroads, and the tragic fact is that neither the majority of our educators nor the American people as a whole seem aware of it. The engineering profession is being called upon to produce more and better guns without any interference with the production of more and better butter. We can improve our defenses without lowering our standard of living only if we receive into our ranks more and better young engineers.

To improve our own profession is the greatest task that confronts us today. Toward this end we must first reorient American thinking away from the extreme "progressive" ideal for our educational system towards some more reasonable ideal which will assure to our nation its lifeblood of engineering talent. If we fail in our task, our nation may well fail us; but if our efforts are crowned with success, we will see the inauguration of a new era of peace and prosperity for all Americans.

Our rapidly changing technology—its impact on sanitary engineering

Speaking of our rapidly changing technology, it is probably the rapidity of change rather than the change itself that will exert the greatest impact on the practice of sanitary engineering. By way of example, annual energy consumption in this country, in terms of mineral fuels and water power, is up about 500 percent over 1900. Moreover the annual rate of change is still increasing. In the past ten years, the annual increase has been double the average annual increase in the previous 40 years. Expressed graphically, we have entered the steep portion of what might be called a huge S-curve of technological development. We are rapidly losing the cushion of time which traditionally we have had for evaluating trends, making adjustments, and considering by-product consequences. Today the effects of technological development often are upon us before the trends are even recognized.

Not as a definition but as a philosophy, sanitary engineering is a science of the environment. It deals with the stresses—especially the abnormalities introduced by man—in air, water, food, and shelter. We apply engineering principles to eliminate those stresses man need not bear and to moderate those which he must bear.

Sanitary engineering emerged in response to the needs of a young nation in its period of transition from rural to urban life. The profession was dedicated originally to the water phase of the environment—water supply and sewage. It also played a prominent role in the control of insect vectors of disease. Even at that time however, many in the profession clearly perceived that the scope of sanitary engineering should embrace the total environment. This broad philosophy has been reflected in most definitions of the sanitary engineering field.

While the complexities of sanitary engineering are continually increasing, we are still dealing with the fundamental health-related factors of air, water, food, and shelter. Our interest today is in the impact of modern technology—for example, in the chemical industry and atomic energy—on these four fundamentals.

It is becoming increasingly apparent that chemicals in municipal and industrial wastes will require severe modifications in our conventional biological treatment processes. The figures for overall chemical production are phenomenal. Total chemical production today is more than 300 percent greater than in 1936. By-product wastes are changing the composition of municipal sewage so much that our traditional concepts of sewage treatment are challenged. In water treatment technology we simply don't know whether conventional practices will meet the new needs. One wonders also at what stage of synthetic chemical loadings there might develop discernible physiological effects on humans.

Growth of atomic problems

For sanitary engineers, the atomic age means an entirely new set of terms, units, formulas, and equations. Research is under way leading to a better understanding of the effects of radiations on various aspects of air, water, food and shelter. This is just a warm-up exercise requisite to the generalized use of atomic energy. It has been predicted that facilities to produce an additional 1,000 billion kilowatt-hours of energy annually will be built during the next 25 years, and that in the next 10 years at least 10 percent of all new electrical power plants will be using atomic fuel. On that basis, it is estimated that there will be 1.5 billion curies of radioactive fission products present at the end of a single year's operation of the reactors in production a decade hence.

The sanitary engineer must strive continually to have built into the industrial processes protective devices for minimizing by-product discharges, to develop practical techniques for measuring levels of radiation concentration in the environment, and to suitably modify community facilities such as water and waste treatment works to maintain these barriers protecting the public health. If precedent is followed, it is unlikely that the rate of expansion in the application of atomic energy will await conventional solutions of these health problems any more than the development of automobile travel awaits solution of the problem of traffic accidents.

Air pollution—parallel problem

Community air pollution is another impact of our modern technology. There are a number of parallels between the air pollution problem and the water pollution problem. The problem is to determine what concentrations of pollutants are permissible and to devise economical and equitable methods of keeping such pollution within bounds. In the field of community air pollution, we should profit by some of the early mistakes made in dealing with water pollution.

While it is true that community air pollution became acute only with the industrial expansion of World War II, nevertheless we should have foreseen this situation and should have initiated action at least to obtain preliminary data on the identity, concentrations, and behavior of toxic materials being increasingly discharged to the air. Instead of dealing primarily with smoke, we have learned that our problems involve invisible fumes, gases, mists and particulate matter, and unknown synergistic combinations of these. The Donora tragedy and the problem at Los Angeles merely highlight a widespread generalized situation. There are already indications that smogs over metropolitan areas are becoming so diffused as to constitute virtual blankets over wide geographical regions.

MARK D. HOLLIS, M. ASCE

Assistant Surgeon General and Chief Engineer,

U.S. Public Health Service, Department of Health,

Education, and Welfare, Washington, D.C.

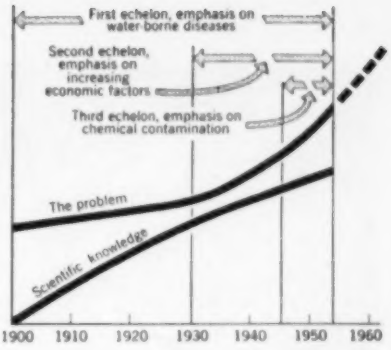


FIG. 1. Relationship between technical problems of sanitary engineering and scientific knowledge required for their solution is shown in graph.

With respect to toxic chemicals in air as well as in water, a great deficiency is our limited knowledge about the effects of such materials on humans, especially the long-range effects of low concentrations. A hard look into this field of toxicology shows surprisingly meager knowledge for an area of this importance.

Food sanitation

In the field of food, sanitary engineers have in the past worked principally on control of bacterial contamination, generally at the point of consumption. Food sanitation inspection service continues to use more than 50 percent of local health department sanitation budgets. Since World War II startling changes have occurred which present a new situation. New food processes—quick freezing, vacuum drying, vacreation, irradiation, etc.—provide many opportunities for "built-in" health protection. The expanding use of chemicals is also profoundly affecting the food industry, again with limited data as to the long-range effects on health. Each year brings uses of new and more chemicals, for control of insects in food production, as preservatives and conditioners in processing and as additives for nutritional benefit.

Our final or fourth area of environment is that of shelter—not just the house but including extensions of the family roof in the neighborhood, recreational areas, schools, and places of occupation. In the past five years, for example, the number of community health departments dealing with the hygiene of housing programs has increased from a bare few to more than 100. In this area sanitary engineering borders on the fields of chronic disease and mental health.

In considering the impact of modern technology on all these aspects of environment, we can conveniently classify the historical development of sanitary engineering in terms of three echelons.

The first echelon is concerned primarily with enteric disease control—treatment of water supplies, safe handling of sewage, and protection of food. Control of significant insects and rodent vectors of disease also is included.

The second echelon is concerned with advanced water and sewage treatment technology, including reclamation of valuable organic components, and with revolutionary changes in food processing.

The third echelon is in transition, and represents a major mutation in civil engineering practice. As previously noted, the big factor in this stage is an appreciation of a rate of technological change unprecedented in history. The widespread use of chemicals in the production and processing of foods, the increasing use of artificial fibers for clothing, construction, and countless household items, together with contamination of air and water by chemical wastes, constitute an extremely complex situation. The atomic age will simply compound the problem. We are moving more and more toward a synthetic environment. We live in an age of high velocities, high voltages, high living, and high blood pressures.

To solve these complex problems, across-the-board research is needed. Few people realize how much research is needed, and how soon. In sanitary engineering, the gap between what we know and what we must find out is becoming greater and greater. The new Sanitary Engineering Center of the Public Health Service at Cincinnati will devote its full resources to this effort. However, the total amount of research now conducted in sanitary engineering is far short of the needs. Figure 1 illustrates our present position.

Prospects for the future

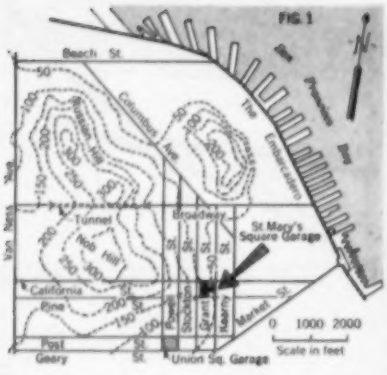
To solve our increasing problems requires not only competence in engineering, but also a clear understanding of such other disciplines as chemistry, biology, and physics. The sanitary engineer today must apply a composite of these sciences to an unprecedented degree. He must team up with his colleagues in these and other related sciences.

Sanitary engineers have been exploring ways for improving their capacities and broadening their perspective. Several practical recommendations have been made. Included is one that sanitary engineers develop practical means to improve their professional organization. Sanitary engineers are mostly civil engineers who have had either specialized training or experience in one or more aspects of environmental control. We need a yardstick to measure this kind of competence, in order to gain proper recognition and apply the influence the profession merits.

Action taken the past year toward establishment of a national board of certification is encouraging. With a board similar to those now employed by physicians and dentists, we can designate those who have achieved acknowledged ability in the profession. This would be the first specialty engineering certification program undertaken in this country.

Sanitary engineering is undergoing its first major transition. In this period of adjustment there probably will develop some major differences among various groups in the profession. We should not exaggerate such differences since it is timely and proper that we have frank and open debate—among engineers in the interest of engineering—with the objective of complete understanding even though among us there may not be complete agreement. From it all should come new strengths and new wisdom.

(This article is an abstract of the paper presented by Mr. Hollis at the ASCE Atlanta Convention, in the symposium on New Horizons in Sanitary Engineering, before the session of the Sanitary Engineering Division presided over by Daniel A. Okun and W. N. Grune, members of the Division's Committee on Programs and Publications.)



Lucite model (below) of six-story St. Mary's Square Garage shows park replaced over back part of structure. Roof over front part will provide supplementary parking space.

Excavation and construction proceed simultaneously, as seen in photo taken in August 1953. Poplar trees at rear are part of original park which is to be restored over back part of garage. Stepped plan in rear gives stability to 51-ft-deep excavation. Kearny Street entrance runs between buildings in lower right. North is to right.

San Francisco builds parking facility for 1,025 cars

St. Mary's Square underground garage under construction

JOHN J. GOULD, M. ASCE

Consulting Engineer, San Francisco, Calif.

San Francisco, like most major cities, has a major parking problem. To help alleviate this problem, the city in 1942 built the first major underground garage in the United States, under Union Square, opposite the St. Francis Hotel. A second similar venture, for 1,025 cars, is nearing completion under the famous St. Mary's Square Park (Fig. 1).

The St. Mary's Square garage, located at Kearny, Pine, and California Streets, near San Francisco's historic Chinatown, is being built by private capital on land made available by the City and County of San Francisco. In 1952 the San Francisco Parking Authority called for competitive bids on the design, construction, and operation of the garage in a single package. The St. Mary's Square Service Center, Inc., headed by B.A. Farlatti and S.E. Onorato, was the successful bidder for furnishing a garage with 810 regular stalls. The price for constructing the garage was negotiated between the St. Mary's Square Service Center, Inc., and the contractor, Haas & Haynie. The garage will revert to city ownership after 33 years of operation, during which time the city will receive a minimum rental of $1,225 per month, or 4 percent of the gross income, whichever is larger.

A major factor in the successful bid was the design of a structure which would economically solve the problem of the steeply sloping site (Fig. 2). The site is located near the bottom of the east face of San Francisco's famed Nob Hill, which has a grade of about 15 percent at St. Mary's Square. Five stories are necessary to provide the minimum number of

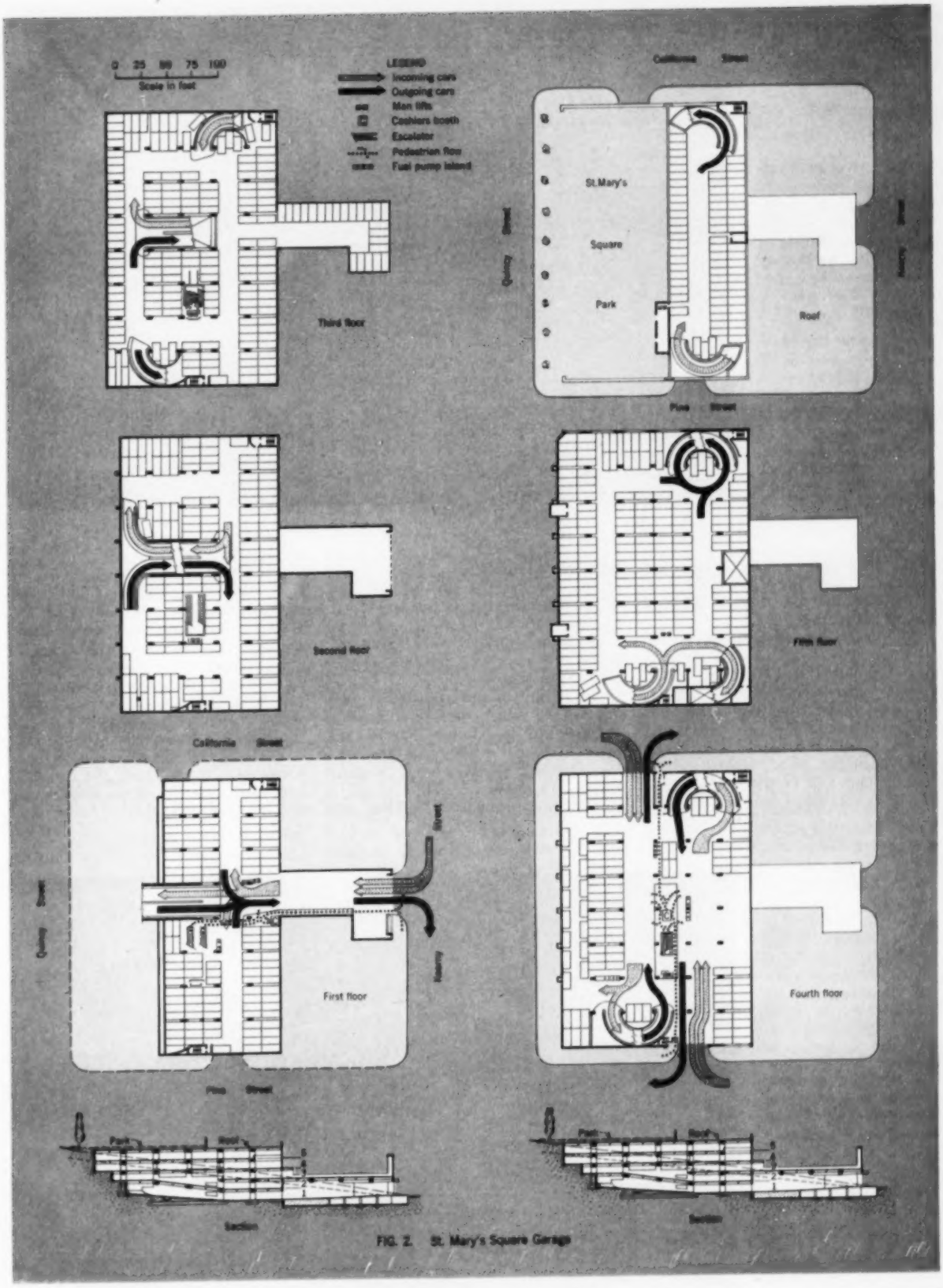


FIG. 2. St. Mary's Square Garage

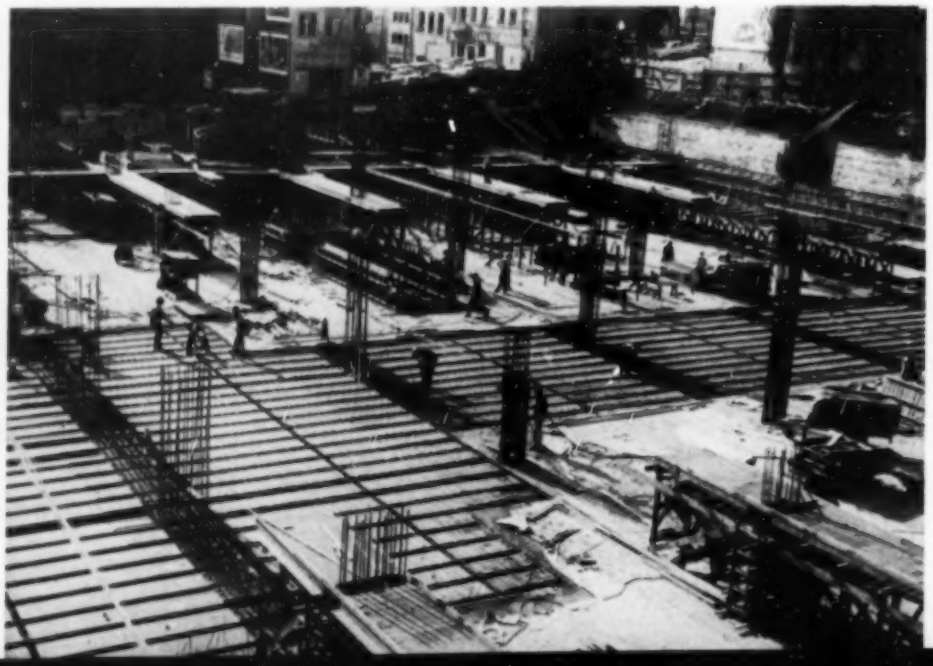
Method used in constructing exterior walls (along Pine Street, in background) and adjacent floors avoids expensive support for excavation. Steam shovel is here seen at lowest floor level in August 1953.

stalls, requiring a total excavation depth of 53 ft between the high point of the park and the level of the first floor of the garage.

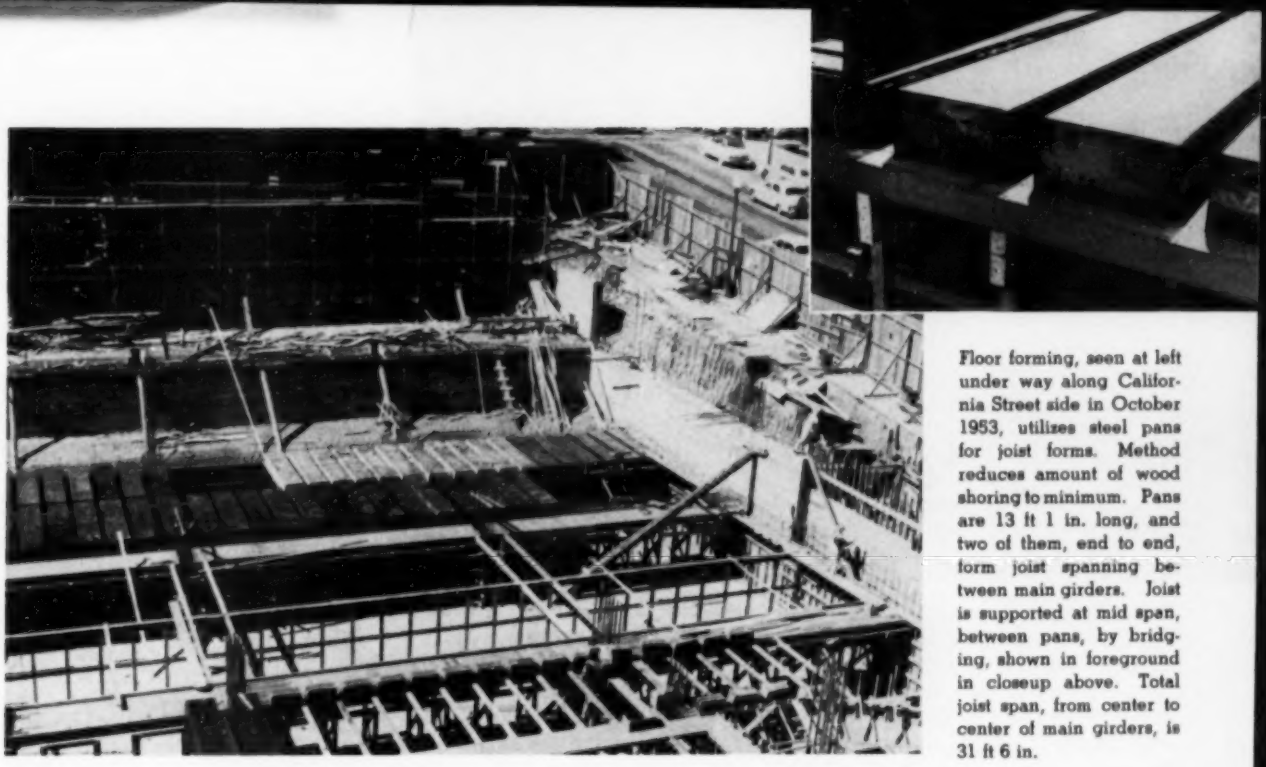
Soil investigations revealed about 10 ft of fill material at the surface, and then clay and shale layers which become harder with depth. Neither the slope of the bedding planes nor the possibility of slippage along these planes could be determined from the small borings. If a vertical cut 53 ft deep and 275 ft wide were made into the hill, there was the distinct possibility that bad slides would occur, causing damage to adjacent streets, utilities, and buildings. In addition to this danger, such an excavation would require extremely heavy shoring and a great increase in construction costs.

To reduce these hazards, it was decided to start with a relatively shallow cut at Quincy Street, the upper part of the property, and step the building down toward Kearny Street, as shown in Fig. 2. As a further precaution, the building line was kept 17 ft inside the property line, thereby providing additional construction room and allowing the poplar trees along the Quincy Street frontage of the park to remain in place during construction. This precaution not only avoided replanting the trees, but retained their roots which it was felt would help hold the top layers of the soil in place.

The stepped design had other advantages. It reduced the excavation yardage, reduced the total lateral soil pressure on the building, and



By January 1, 1954, fourth-floor steel was in place, ready for final pour. Pine Street entrance and circular ramp are at top left.



Floor forming, seen at left under way along California Street side in October 1953, utilizes steel pans for joist forms. Method reduces amount of wood shoring to minimum. Pans are 13 ft 1 in. long, and two of them, end to end, form joist spanning between main girders. Joist is supported at mid span, between pans, by bridging, shown in foreground in closeup above. Total joist span, from center to center of main girders, is 31 ft 6 in.

provided a structure that would be more stable against possible earthquake forces.

Internal traffic pattern

Two major requirements presented themselves in the development of the layout of the garage. One was the ability to absorb automobiles from the adjoining streets at the fastest possible rate, and the other was the provision of a speedy and efficient traffic pattern within the garage.

To fill the first requirement, adequate entrance capacity was provided in the form of three separate entrances, one on Kearny Street, one on Pine Street, and one on California Street, each capable of handling two-way traffic. The Kearny Street entrance leads directly to the first floor and has a reservoir space about 160 ft long. The entrances from California and Pine Streets each lead onto the fourth floor into a reservoir area about 240 ft long. Thus these marshaling areas provide room for an additional 70 cars, as well as a cushion within the garage which enables it to siphon traffic off the streets without waiting or congestion.

The second requirement, an efficient internal traffic pattern, determined the location of the ramps. From the Kearny Street entrance on the first floor, a straight ramp near the center of the building leads up to the second floor. Directly above this is a straight ramp from the second to the third floor. Most of the automobiles entering from Kearny Street will be parked on the first and second floors. The third floor will be used for cars coming in from Pine Street.

At the ends of both reservoir spaces on the fourth floor are located semicircular ramps. A car coming in from Pine Street would go down the north ramp to the third floor and park. On leaving, it would come up the south ramp and exit on California Street. Similarly, a car coming in from California Street would take the south ramp up to the fifth floor or the roof to be parked. For delivery it would come down the north ramp and proceed out to Pine Street. The garage is arranged so that most of the cars (92 percent) will have to travel only one floor up or down from stall to customer.

On the fourth floor, the public area is located between the two aisles and is served by an escalator from the first floor, which enables the public coming in on the Kearny Street level to have ready access to the entire garage without climbing any stairs or ramps. This area contains the waiting room, cashier's booth, and public telephones. Also on the fourth floor are all facilities for washing, lubrication, and sale of gasoline, as well as public rest rooms, offices, and employees' locker and rest rooms.

The first floor also will include a cashier's booth and public waiting area along with public rest rooms, telephones, and gasoline pump facilities, so that for all practical purposes the first and second floors can be operated as a unit, independent of the rest of the garage, if so desired.

Pans save form work

In choosing the framing scheme, it was found that the column spacing was a very important factor because it governed the parking and traffic pattern within the garage. In the north-south direction, columns were spaced 33 ft 6 in. on centers, far enough apart for four cars to be parked between them. This spacing reduced the total number of columns in the structure and allowed a greater number of cars to be parked in the same area. To save additional space, the columns were made rectangular in shape (18 in. × 54 in.) with rounded ends. The concrete columns are reinforced with three columns of steel, some tied and some with spirals. The concrete for the columns was specified to attain a compressive strength of 5,000 psi at 60 days. Columns in the east-west direction are for the most part spaced 31 ft 6 in. apart.

The floor framing consists of concrete joists spanning 31 ft 6 in. between girders, which in turn span 33 ft 6 in. over the columns. Joist construction was used because of its economical form work, its relatively light weight, and its stiffness. The joists used are of special interest because of the pan forms used. All the pans have the same length, 13 ft

Walls of Ramp No. 1, running up from Kearny Street entrance, support deep excavation. This view shows progress of work in May 1953 looking toward California Street.

1 in., which is the distance between the girder and the row of bridging in the center of the span. The soffit of the joist was formed by clamping together the horizontal flanges of adjacent pans. In this way, the usual wooden form for the soffit was eliminated and no shores were required under the joists. The only shoring required is under the girders and bridging. The framing was arranged for maximum reuse of the pans on all floors.

Most of the pans are 30 in. wide. The joists, between the ends of the pans, are $5^1/_2$ in. wide by $18^1/_2$ in. deep. Of the $18^1/_2$-in. depth, 15 in. is stem and $3^1/_2$ in. is floor slab. Concrete for walls and floor system was specified to develop 3,250 psi at an age of 28 days.

A typical floor girder is 54 in. wide by 23 in. deep. This shallow girder was chosen to reduce the floor-to-floor heights and to save excavation and total wall height. In addition, wide girders provide an effective haunch at the ends of the joists, thereby increasing their stiffness.

The same size of girder was used throughout except for that part of the roof under the park, which presented a special problem, as it had to support the new park of St. Mary's Square. The planting areas of the park are provided with 20 in. of topsoil and 4 in. of crushed rock on the roof slab for drainage. The structural slab will be waterproofed with a membrane which in turn will be protected with a covering of 3 in of concrete. This, together with 100 psf for live load, gives a superimposed load of 380 psf on the roof framing, as compared to 75 psf on the typical floor. The roof framing is similar to the floor system and generally used the same forms. The roof girders under the park are 54 in. × 34 in.

The park of St. Mary's Square, which is being replaced over the roof of the garage, has been redesigned and beautified with ample walkways and lawns and an abundance of shrubs and trees. In addition to the park surface, trees and flowers will be located in planting boxes adjacent to the sidewalks along California and Pine streets. To complete the beauty and interest of the park, the famous marble and stainless steel statue of Dr. Sun Yat Sen will be replaced in its old location in front of the existing poplar trees.

Construction and excavation proceed together

The value of the stepped design of the bottom floors was proved in the construction of the project. The first excavation was made at the center of the building at ramp No. 1. The 18-in. walls, when poured to the third floor level, acted as buttresses to support the exterior walls in this part of the building. In this way the first construction virtually replaced the supporting qualities of that part of the hill before other deep cuts were made.

To keep the excavation moving, the next step was to excavate an area about 45 ft wide adjacent to Pine Street, leaving an island between this cut and the buttress. The cross walls were poured and braced and the Pine Street wall was poured two stories high and braced and backfilled for a height of about 8 ft. The walls were backfilled with sand placed in layers and tamped.

With the central buttress complete and the Pine Street wall adequately shored, excavation started on the area between the ramp and California Street, working from the top down. The hill was cut down to the fourth-floor level, and the back wall was poured up to the fifth floor. Part of the slab on the ground was poured and the wall braced. This procedure was repeated down to the first-floor level. With the hill well braced from California Street to the central ramp, the remaining island between the Pine Street construction and the central ramp was then removed in a manner similar to that used along California Street. As soon as excavation was completed down to the first-floor level, construction of the floor was begun. From this point, the building rapidly took shape.

Each floor generally was completed in three separate pours, each pour requiring about 500 cu yd of concrete. Because of the long spans, the quality of the concrete was closely controlled, especially for the floor systems. These pours were made using concrete with a slump of 3 to 4 in., which gave a good workable mix and yet kept the water content relatively low.

The garage is equipped with a mechanical exhaust ventilation system which will provide six complete changes of air per hour. There are six plenum chambers which collect the air from various parts of the building and discharge above the roof.

The entire garage is equipped with an automatic sprinkler system.

The quality of the workmanship on this project has been excellent and the job has proceeded with little or no delay. Much of this can be attributed to the cooperation of all parties concerned and to the excellent management of Haas and Haynie, contractors with A.E. McDonald, superintendent. The opening date for the garage is expected to be May 1, 1954.

The design and general supervision of construction were by the author, with H. J. Degenkolb, M. ASCE, chief engineer, and T. D. Wosser, assistant chief engineer.

Associates on the project were: G. M. Simonson, consulting electrical and mechanical engineer; Rudolph Igaz, Jr., consulting architect; Eckbo, Royston & Williams, landscape architects; and Dames & Moore, foundation consultants.

Vertical-curve elevations found by addition

CURTIS R. TAYLOR, Chief Inspector, Texas Highway Department, Houston, Tex.

Present-day vertical curves for highways are quite long, and the computation of elevations at each half station by the usual tangent grade-correction method requires a calculating machine. The method described below obviates the necessity of squaring distances greater than 50 ft and reduces the major part of the computation to addition and subtraction.

In the equation,

$$A + Gx + Cx^2$$

C is usually derived from the external distance, E, which entails a squaring. By equating the first derivative to g, the result is

$$C = \frac{g - G}{2L}$$

where G and g are given tangent grades in percent, and L is the length of the curve in 100-ft stations.

Let k be the distance, less than a half station, from the point of curvature to the next half or full station. Then the elevation of the first point on the curve is

$$A + Gk + Ck^2. \quad . \quad . \quad . \quad (1)$$

Elevation of second point is

$$A + G(1/2 + k) + C(1/2 + k)^2 \quad . \quad (2)$$

Elevation of third point is

$$A + G(1 + k) + C(1 + k)^2. \quad . \quad . \quad (3)$$

Eq. 2 minus Eq. 1

$$= 1/2G + 1/4C + Ck \quad . \quad (4)$$

Eq. 3 minus Eq. 2

$$= 1/2G + 3/4C + Ck. \quad . \quad (5)$$

Eq. 5 minus Eq. 4 $= 1/2\,C. \quad . \quad . \quad . \quad (6)$

Then, to compute elevations of curve points, evaluate Eqs. 1, 4, and 6. To Eq. 1 apply the value of Eq. 4 to obtain Eq. 2. To Eq. 4 apply Eq. 6 and apply the result to Eq. 2 to obtain Eq. 3. Apply Eq. 6 to the result of Eqs. 4 and 6, and apply this result to Eq. 3 to obtain the elevation of the fourth point on the curve.

Continue to apply Eq. 6 to the immediate prior result and this result to the immediate prior elevation to obtain the successive curve points up to the last half station point.

Compute $g(1/2 - k) + C(1/2 - k)^2$ and apply to the elevation of the last half station point to obtain the elevation of the point of tangency.

Check the mid-point by the external distance, E, and the point of tangency by the tangent grades.

The advantages of this method are:

1. A great saving in the labor of computation.
2. Ease of application.
3. Assurance of correctness of all point values because each point value depends upon the previous one, and if the end one is correct they are all correct.
4. It can be used on the calculator without shifting the carriage, making for a still greater saving of time and labor.
5. It can be used for any constant interval by determining the appropriate part of C.

Tables give area of segment and length of arc

KANKICHI TAIRA, J.M. ASCE, Senior Inspector, Pennsylvania State Highway Department, Easton, Pa.

For the convenience of engineers who frequently have to find the area of a circular segment of a circle or the length of an arc, simple tables have been worked out by the writer and are presented here.

To find area of segment

In finding the area of a circular segment of a circle, the nomenclature shown in Figs. 1 and 2 is used. The area, $A = c_a l\ m$, in which c_a is a coefficient.

By the approximate method, c_a is taken as 2/3. This value is accepted by the Pennsylvania Department of Highways for computing area.

By the exact method, values for c_a are taken from Table I. These values can be used in the field without appreciable error. They were found from Eq. 3, which was derived as follows:

$$l = 2r \sin\frac{\theta}{2};\ m = r\left(1 - \cos\frac{\theta}{2}\right)$$

$$x = \frac{c_a}{2}\,m = \frac{c_a}{2}\,r\left(1 - \cos\frac{\theta}{2}\right)$$

$$s_1 = \frac{1}{2}\,r^2\theta - \frac{1}{2}\,l\,r\cos\frac{\theta}{2}$$

$$s_1 = r^2\left(\frac{\theta}{2} - \cos\frac{\theta}{2}\sin\frac{\theta}{2}\right) \quad . \quad . \quad . \quad (1)$$

$$s_2 = \frac{1}{2}\,l\,x = r\sin\frac{\theta}{2}\cdot\frac{c_a}{2}\,r\left(1 - \cos\frac{\theta}{2}\right)$$

$$s_2 = r^2\sin\frac{\theta}{2}\left(1 - \cos\frac{\theta}{2}\right)\frac{c_a}{2}. \quad . \quad . \quad (2)$$

Eq. 1 = Eq. 2

$$\therefore\ c_a = \frac{\theta - \sin\theta}{\sin\dfrac{\theta}{2} - \dfrac{\sin\theta}{2}} \quad . \quad . \quad (3)$$

If θ exceeds π, use the equation,

$$c_a = \frac{\theta + \sin\theta}{\sin\frac{\theta}{2} + \frac{\sin\theta}{2}}$$

To find length of arc

When the length of the chord and the middle ordinate are known, the length of the arc is found as follows:

By the approximate method, $s = 0.94\,(l + m)$.

By the exact method, $s = c_s\,(l + m)$. The values for the coefficient c_s given in Table II can be used without appreciable error. These values were found from Eq. 6, which was derived as follows:

$$l = 2\,r \sin\frac{\theta}{2} \text{ (See Fig. 3.)}$$

$$m = r\left(1 - \cos\frac{\theta}{2}\right)$$

$$s_1 = r\,\theta \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

$$s_2 = c_s\,(l + m)$$

$$s_2 = \left(2 \sin\frac{\theta}{2} + 1 - \cos\frac{\theta}{2}\right) r\,c_s. \quad (5)$$

Eq. 4 = Eq. 5

$$\therefore c_s = \frac{\theta}{2 \sin\frac{\theta}{2} + 1 - \cos\frac{\theta}{2}} \quad \ldots\ldots (6)$$

TABLE I. Values of coefficient c_a

θ deg	c_a	θ deg	c_a
10	0.656	100	0.695
20	0.666	110	0.701
30	0.667	120	0.709
40	0.670	130	0.717
50	0.672	140	0.730
60	0.676	150	0.738
70	0.681	160	0.756
80	0.685	170	0.768
90	0.689	180	0.786

TABLE II. Values of coefficient c_s

θ deg	c_s	θ deg	c_s
10	0.981	100	0.925
20	0.963	110	0.932
30	0.950	120	0.937
40	0.940	130	0.948
50	0.930	140	0.965
60	0.924	150	0.978
70	0.923	160	0.998
80	0.920	170	1.02
90	0.922	180	1.05

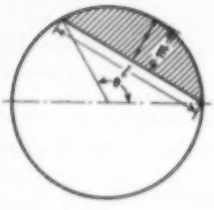


FIG. 1

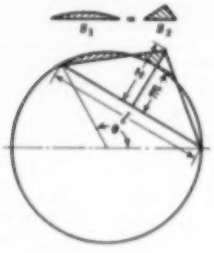


FIG. 2

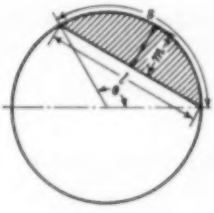


FIG. 3

THE READERS WRITE

Many compensations come to engineer working in Middle East

TO THE EDITOR: May I add a thought or two to Mr. Seran's most interesting letter on the Middle East, in the December issue (page 69)? Indeed, the need for engineers in the Middle East is great and will continue to grow for many years. Specialization, at this stage, is not as necessary as it is in this country. The need is for engineers with wide experience, with judgment, vision, imagination, maturity, and a broad engineering outlook—above all, for men with social sense.

The Middle East has many young, educated men who can accomplish engineering work under the guidance of experienced American engineers. Using these young engineers has the added advantage that it will assure that the area will eventually become self-sufficient in its technical manpower. American companies are finding that native labor quickly learns to operate complicated construction equipment, under the guidance of experienced American operators.

Western engineers working in this area will exert the most lasting influence if they confine their activities mainly to advising, guiding, and consulting, leaving the actual accomplishment of the work to the local people. In this manner, the natives can be made to feel that they are sharing in the development of their countries, and that it is their own work, not something wished on them.

I have noticed all too frequently cases where our Western methods and procedures were transplanted into the Middle East, completely out of the environment in which they were developed. In many instances they proved to be uneconomical or unsuitable. Solutions must be adapted to the needs of the area.

As implied by Mr. Seran, age may be a deterrent in a few cases, but I feel that it should not be so as a rule. The engineer who starts from this country in good physical condition, if he observes reasonable care in living habits, food, and drink, should not have much trouble. The principal difficulty is that it is human nature to relax precautions and restrictions when it is necessary to abide by them for long periods of time. Fortunately the handling of food is improving at an amazingly rapid rate, and safe water supplies are becoming increasingly available.

Many compensations that cannot be measured in financial terms come to the engineer working in the Middle East. Adventure, travel, contacts with new people and a different way of life, all tend to keep him young in spirit, more adaptable, and more cosmopolitan in his viewpoint. A closer acquaintance with that part of the world in which three of the world's major religions originated, as well as many of the things we take for granted in daily life, develops a deep sense of humility and a feeling of kinship with one's fellow man.

Finally—a prophetic sally—I am satisfied that the type of world in which our children will live, is going to depend to a large extent on what happens in the next decade in the Middle East. Those of us who have contributed to the developments there will have the satisfaction of knowing that we have shared in the molding of our children's world.

The Middle East gets you in spite of yourself. I guarantee that you will find satisfaction, pleasure, and challenge, and that you will have a completely different outlook by the time you set foot on American soil again.

E.A. ABDUN-NUR, M. ASCE
Consulting Engineer and
Middle East Consultant
Denver, Colo.

Freeman Fellow finds interesting hydraulic activity abroad

TO THE EDITOR: As recipient of the Freeman Traveling Fellowship in Hydraulics for the current school year, I arrived in Bremerhaven, German, Sept. 7, 1953, on board the Naval Transport *General Callan*. The Army was very cooperative and allowed my automobile to come over on the same boat. As I drove through the Rhineland on my way to Paris, I was amazed to see the industrial progress made there since I was stationed in Germany just after the war. In no other country did I see such feverish activity.

In Paris I met Gail Hathaway, Past President ASCE, who was there as American representative to the International Committee on Large Dams. I attended an executive meeting as his guest. He and I left Paris for Holland on September 13. In Delft I was introduced to Professor Thijsse, director of the Waterloopkundig Laboratory, and visited the island of Schouwen-Duiveland, where big construction work was in progress to close breaches in the dikes. After Mr. Hathaway left, on Sept. 16, I remained for two weeks at the laboratory, where a very large model of all Holland was being studied to see if the estuaries could be closed so as to drastically reduce the mileage of dikes to be raised.

My third week in Holland, Engineer Volker and I made a complete inspection tour of the Zuiderzee works, visiting the largest lock in the world at Ijmuden, which however has a lift of only 5 ft. During the whole trip winds of about 45 miles an hour were blowing, and it was interesting to see the wave action caused by such a gale. Wave action had displaced huge basalt rocks weighing 800 lb.

One day was spent at De Bilt, home of the Royal Netherlands Meteorological Institute, which has the unenviable task of predicting surges in the North Sea. I was able to pass on the results of much valuable work done on the reduction of gradient winds to surface winds by the Hydrometeorological Section of the United States Weather Bureau.

My fourth week in Holland was spent with the engineers of the Rijkswaterstaat, which has general charge of all coastal and river defenses, exclusive of the Zuiderzee. We discussed the destruction of dikes by the storm. A sea surge actually was the main cause of the great flood.

For a better understanding of the phenomena of sea surges I went to Stockholm to see Professor Bo Hellstrom, whom I had previously met in Paris, and spent five days in his laboratory discussing mainly wind effects on lakes and seas. Although the Dutch have done fine work analyzing the tangential stress of wind over water, Professor Hellstrom has written one of the best treatises on the subject. The autumn drive to Stockholm via Copenhagen was delightful. It was however a trifle arduous to make a 2,000-mile trip in ten days, five of which were spent in Stockholm.

On October 21, I arrived in Grenoble, France, and was very favorably impressed with the hydraulic laboratory there. Just trying to get settled in France is a man-sized job, however. Apartments are nonexistent. Prices are sky high.

On November 4, I received telegrams from Holland asking me to come and witness the closing of the dikes at Ouwerkerk, and I got there just in time to get in on the whole work. The Dutch could not have treated me better. I had access to all the engineering works by boat or by foot. (By foot usually meant ankle deep in clay.)

Returning to Grenoble, I went to the South of France with Mr. Danel, director of the Grenoble Laboratory, to witness the placing of "tetrapods" in the harbor of La Nouvelle. Tetrapods are four-legged blocks designed by the Neyrpic Laboratory for use in the construction of sea walls.

The next two weeks I was able to get some fundamental work done in Grenoble. In a model study, two designs for a proposed breakwater at Crescent City, Calif., were tested, an American design and one utilizing tetrapods. It is interesting to note that the run-up for both designs was the same but both were unstable on the inside face because of overtopping. The question of the stability of the inside face of dikes and sea walls is most important—at least 80 percent of all damage in the Netherlands is attributed to failure of the inside face.

The Institution of Civil Engineers held a conference in London December 16 and 17, on the North Sea floods, which I attended. I was treated extremely well and gave two short talks. Mr. E. Graham Clark was especially kind, and Professor Thijsse paid me the compliment of offering me his time to speak. While in England I visited the laboratory of G. I. Taylor at Cambridge and the hydraulics laboratory at City and Guilds College, where J. R. Francis is doing much the same type of work I am on wind stress. It was also interesting to visit the National Hydraulics Laboratory of Sir Claude Inglis, still in the construction phase.

I find the work here at Grenoble very enjoyable. I am very thankful for the opportunity to associate with the many European engineers I have met.

IRA A. HUNT, J.M. ASCE
Freeman Fellow
Grenoble, France

NOTE: *Information on this year's Freeman Fellowship awards appears on page 73 of this issue.*

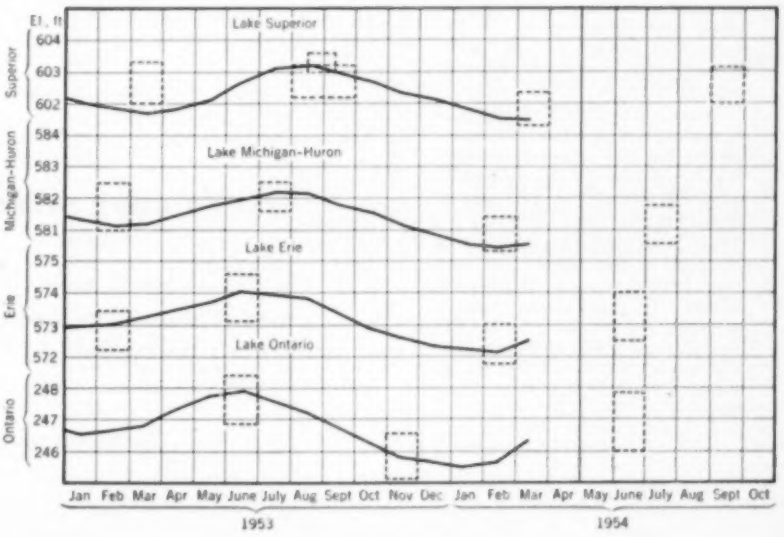
1954 seasonal levels in Great Lakes forecast

TO THE EDITOR: As author of the article "Forecasting Great Lakes Levels Aids Power and Navigation," in the February 1954 issue, I have received many inquiries concerning probable peak levels of the Great Lakes during the summer of 1954. The accompanying Fig. 1 indicates the 95-percent confidence range within which it is anticipated the 1954 peak levels will occur. The midpoints of these ranges may be regarded as the most probable maxima to be reached.

The figure also indicates the measure of success attained in forecasting the winter low levels of 1953-1954, the prediction having been made in early September, based on the mean August lake levels. It will be observed that the March level of Lake Superior indicated that this lake had not yet begun its seasonal rise, but was apparently near the winter minimum level. Thus the predictions were accurate within approximately 0.3 ft on the average, which maintains the level of accuracy of former predictions.

LOUIS D. KIRSHNER, M. ASCE
Assistant Chief, Engineering Division, U.S. Lake Survey, Corps of Engineers
Detroit, Mich.

FIG. 1. Hydrograph of levels of Great Lakes shows predictions for 1954 summer highs and winter lows. Range of predictions is indicated by dashed boxes.



AMERICAN SOCIETY OF CIVIL ENGINEERS

ATLANTIC CITY CONVENTION

Haddon Hall Hotel Atlantic City, N. J. June 15–18, 1954

SPONSORED BY PHILADELPHIA SECTION

REGISTRATION

Haddon Hall Hotel, Stair Hall, Lounge Floor

Registration fee, except for ladies and students, $3.00.

Hours: Tuesday, June 15, through Thursday June 17, 9:00 a.m. to 5:00 p.m. and Friday, June 18, 9:00 a.m. to noon.

AUTHORS' LUNCH AND BREAKFAST

Tuesday, June 15, 12:00 Noon
Wednesday, Thursday, Friday, 8:00 a.m., Sun Porch

Presiding: Samuel T. Carpenter, Chairman, Technical Program Committee

Briefing sessions for all speakers and program officials by invitation.

ADVANCE ATTENDANCE INFORMATION

To assure adequate preparation to make your attendance at the Atlantic City Convention most satisfactory, the Committee requests your assistance.

It is most helpful to have guidance in the number of persons to be expected for the various functions. Will you please use the coupon on page 109, sending this to Harry J. Engel, Registration Chairman?

There is no obligation attached to your use of this coupon. It is a procedure being tested by the committee. It can be very helpful, with your cooperation. If you wish, you may send your check to cover the registration fee and tickets reserved. However, this is not necessary.

TUESDAY AFTERNOON, JUNE 15

General Session

Sponsored by Committee on Conditions of Practice

2:00 p.m. **West Room**

Presiding: G. Brooks Earnest, Vice President ASCE, Chairman Committee on Conditions of Practice

2:00 Report of the Committee on Junior Members
J. M. GARRELTS, Chairman, Committee on Junior Members.

2:15 What about Collective Bargaining?
CHARLES W. YODER, Vice Chairman, Committee on Employment Conditions; and L. STEWART McCOY, J.M. ASCE

3:00 Discussion

3:15 The Cincinnati Program for the "First Five Years of Professional Development"
CORNELIUS WANDMACHER, M. ASCE, Chairman, ECPD Committee on Training.

3:45 Discussion

Surveying and Mapping Division

2:00 p.m. **Rutland Room**

Presiding: R. H. Lyddan, Chairman, Executive Committee, Surveying and Mapping Division

2:00 Introduction
A. O. QUINN, A.M. ASCE, Chief, Engineering and Field Survey, Aero Service Corp., Philadelphia, Pa.

2:15 Photogrammetry Aids the Pennsylvania Turnpike
G. B. Gilbert, Pennsylvania Turnpike Commission, Harrisburg, Pa.

2:45 Integration of Photogrammetry with Engineering Surveys
L. A. DICKERSON, M. ASCE, Construction and Development Division, Lockwood, Kessler and Bartlett, Inc., Great Neck, N.Y.

3:15 Photogrammetry in City Planning Operations
L. A. WOODWARD, Jack Ammann Company, San Antonio, Tex.

3:45 Photogrammetry Aids Big Steel—A Description of Surveying and

Send your reservations in early!

The Convention Manager of the Haddon Hall Hotel has requested that reservations be mailed as soon as possible, preferably before June 1. Please use blanks on page 109.

LOCAL SECTIONS CONFERENCE

Monday and Tuesday, June 14–15

9:30 a.m. — **Vernon Room**

Representatives of Local Sections of ASCE in the area about the convention location will convene for discussion of expanding activities of the Society at local level. The conference, which is primarily for invited delegates of selected Sections, will be open to all who may be interested in the activities and operational details of ASCE Local Sections.

GOVERNOR'S LUNCHEON

Wednesday, June 16 — **12:30 p.m.**

Carolina Room — **Chalfonte Hotel**

Presiding: Oliver W. Hartwell, Director, ASCE, General Chairman, Executive Committee, Atlantic City Convention

Address: **Problems of Government** HON. ROBERT B. MEYNER, Governor of New Jersey.

HOWARD T. CRITCHLOW, Past Director, ASCE, will introduce the Governor. All members, their ladies and guests, and friends of ASCE are cordially invited.

Price $2.50 per plate. Tickets for this event must be purchased before 10:00 a.m. on Wednesday.

Mapping Operations at Cerra Bolivar and Fairless Works

THOMAS OFTELIE, Aero Service Corp., Philadelphia, Pa.

4:15 Discussion

Power Division

2:00 p.m. — **Viking Room**

Presiding: Byron O. McCoy, Chairman, Executive Committee, Power Division

2:00 A Modern River Coal Recovery Operation on the Susquehanna River

PAUL LEVIN, Senior Engineer, Pennsylvania Water and Power Co., Baltimore, Md.; and D. I. SMITH, Assistant Chief Engineer, Construction, Pennsylvania Water and Power Co., Baltimore, Md.

2:30 Discussion

DR. ARTHUR CASAGRANDE, M. ASCE, Harvard University; and R. T. LASSITER, M. ASCE, Chief Engineer, Western-Knapp Engineering Co., Chicago, Ill.

2:40 Influence of Design on Costs of Bulk Power System of Philadelphia Electric Company

STANLEY MOYER, M. ASCE, Assistant Mechanical Engineer, Philadelphia Electric Co., Philadelphia, Pa.

3:10 Discussion

3:20 Concrete Repairs for Hydroelectric Developments—Report of Committee on Operation and Maintenance, Hydroelectric Generating Stations

WALTER D. MYERS, M. ASCE, Engineering Designer, Pennsylvania Water and Power Co., Baltimore, Md.

3:50 Discussion

WEDNESDAY MORNING, JUNE 16

9:30 a.m. — **Auditorium**

General Business Meeting of the Society

DANIEL V. TERRELL, President, ASCE, presiding

9:30 a.m. — **Auditorium**

Presiding: Samuel S. Baxter, M. ASCE, Vice-Chairman Executive Committee, Atlantic City Convention

Welcome to Atlantic City

HON. JOSEPH ALTMAN, Mayor, Atlantic City

Response

DANIEL V. TERRELL, President, ASCE

Symposium—Delaware Valley, U.S.A.

10:00 Industrial Growth and Possibilities of the Valley

WALTER P. MILLER, President, Chamber of Commerce of Greater Philadelphia, Pa.

10:20 Regional Planning and Highways

EDMUND N. BACON, Executive Director Philadelphia City Planning Commission.

10:40 Water Supply Problems

FRANCIS S. FRIEL, M. ASCE, Consulting Engineer, Philadelphia, Pa.

11:00 Stream Pollution Control

H. E. MOSES, M. ASCE, Director, Bureau of Sanitary Engineering, Pennsylvania Department of Health, Harrisburg, Pa.

11:20 The Delaware Estuary

CLARENCE F. WICKER, A.M. ASCE, Chief, Engineering Division, U. S. District Engineer Office, Philadelphia, Pa.

11:40 Discussion

WEDNESDAY AFTERNOON JUNE 16

City Planning Division

2:00 p.m. — **Vernon Room**

Presiding: Charles A. Blessing, M. ASCE, Director of City Planning, Detroit Plan Commission, Detroit, Mich.

2:00 Impact of U.S. Steel Corporation's Fairless Works on Regional Planning and Development Needs

RUSSELL VAN NEST BLACK, M. ASCE, Planning Consultant, New Hope, Pa.

2:30 The Capital Program and Budget Procedures of the Philadelphia City Planning Commission

CHARLES A. HOWLAND, A.M. ASCE, Chief, Division of Projects, City Planning Commission, Philadelphia, Pa.

3:00 The Penn Center Redevelopment Project in Philadelphia

VINCENT G. KLING, architect

Highway—Soil Mechanics and Foundations Divisions (Joint Session)

2:00 p.m. — **West Room**

Presiding: W. Mack Angas, M. ASCE, Vice-Admiral, CEC, USN (Retired), Chairman, Department of Civil Engineering, Princeton University

2:00 Effectiveness of Sand Drains on New Jersey Turnpike

CHARLES NOBLE, M. ASCE, Chief Engineer, New Jersey Turnpike Authority; and O. J. PORTER, M. ASCE, Consulting Engineer, Porter, Urquhart and Beavin, Newark, N.J.

2:35 **Prepared discussion**

2:45 **Vertical Sand Drains, Why and When**

JOHN M. KYLE, JR., M. ASCE, Chief Engineer, Port of New York Authority, New York, N.Y.

3:15 **Prepared discussion**

MAURICE N. QUADE, M. ASCE, Parsons, Brinckerhoff, Hall and Macdonald, New York, N.Y.

3:25 **Sand Drains Used in Camden and Point Pleasant, N.J.**

E. A. Henderson, Soils Engineer, New Jersey Turnpike Authority, New Brunswick, N.J.

3:55 **Prepared discussion**

GEORGE HALTON, M. ASCE, Consulting Engineer, Newark, N.J.

4:00 **General discussion**

Hydraulics—Sanitary Engineering Divisions (Joint Session)

2:00 p.m. **Viking Room**

Presiding: W. M. Lansford, Member, Executive Committee, Hydraulics Division; Richard Hazen, Member, Executive Committee, Sanitary Engineering Division

2:00 **Interstate Use of an Interstate Stream**

JAMES H. ALLEN, M. ASCE, Executive Secretary, Incodel, Philadelphia, Pa.

2:30 **New York's Extension of Its Sources to the Delaware**

KARL R. KENNISON, M. ASCE, Chief Engineer, New York City Board of Water Supply, New York, N.Y.

3:00 **Philadelphia's Future Uutilization of Delaware River Water**

SAMUEL S. BAXTER, M. ASCE, Water Commissioner, Philadelphia.

3:30 **Use of Delaware River Water Through Delaware and Raritan Canal**

HOWARD W. ACKEN, A.M. ASCE, Supervisor, Delaware and Raritan Canal, Div. of Water Policy and Supplies, State Dept. of Conservation, Trenton, N.J.; and ROBERT L. HARDMAN, A.M. ASCE, Principal Hydraulics Engineer, Div. of Water Policy and Supply, State Dept. of Conservation and Economic Development, Trenton, N.J.

4:00 **Ground Water in the Delaware River Valley**

HENRY C. BARKSDALE, Staff Engineer, New Jersey Ground Water, U.S.G.S.; and SOLOMON M. LANG, J.M. ASCE, Hydraulic Engineer, Ground Water Branch, U.S.G.S., Trenton, N.J.

Waterways Division

2:00 p.m. **Rutland Room**

Presiding: Clarence C. Burger, Jr., M. ASCE, Chief, Operations Division, Office of the Chief of Engineers, Washington, D.C.

2:00 **Development of the Delaware River for Present and Future Commerce**

COL. B. B. TALLEY, M. ASCE, Division Engineer, North Atlantic Division, Corps of Engineers, New York, N.Y.

Discussion

BRIG. GEN. J. ALEX CROTHERS, Delaware River Port Authority of Pennsylvania and New Jersey, Camden, N.J.

2:30 **Engineering Aspects of Deepening and Widening of Chesapeake and Delaware Canal**

COL. WALTER KRUEGER, JR., Former U.S. District Engineer, Philadelphia, Pa.

Discussion

COL. DANIEL R. NEFF, member, Parsons, Brinckerhoff, Hall and Macdonald, New York, N.Y.

3:00 **Economic Effects of the Proposed St. Lawrence Seaway**

N. R. DANIELIAN, President, Great Lakes-St. Lawrence Association, Washington, D.C.; CARLISLE BARIGERON, Executive Vice Chairman, National St. Lawrence Project Conference, Washington, D.C.

CONVENTION DINNER

Wednesday Evening, June 16

Vernon Room

7:30 Dinner

TOASTMASTER: JOSEPH T. FARRELL, Chairman, Entertainment Committee.

9:00 HON. CON MCCOLE, Mayor of Wilkes-Barre, Pa., Raconteur.

Price for Dinner and Address, $7.50 per person. Dress informal. Tickets for this event must be purchased before 5:00 p.m. on Wednesday.

10:00 Dancing

Registered members and guests of the Convention who could not be present for the Dinner and Address are invited to join the party without charge for dancing.

THURSDAY MORNING

JUNE 17

Sanitary Engineering Division

9:30 a.m. **Viking Room**

Presiding: A. J. Fischer, Member, Programs and Publications Committee, Sanitary Engineering Division

9:30 **Abatement of Pollution of Raritan River—Program for Middlesex County**

E. SHERMAN CHASE, M. ASCE, Partner, Metcalf and Eddy, Boston, Mass.

10:00 **Abatement of Pollution of Raritan River—the Total Program**

ROBERT S. SHAW, Chief Engineer, Bureau of Environmental Health, N.J. State Health Department, Trenton, N.J.

10:30 **Recent Pennsylvania Experiences of Authority Sewage Works Financing**

SAMUEL I. ZACK, M. ASCE, Chief Sanitary Engineer, Gannett, Fleming, Corddry and Carpenter, Inc., Harrisburg, Pa.

Structural Division

9:30 a.m. **Rutland Room**

Symposium on Design of Deep Beams and Girders

Presiding: Neil Van Eenam, Chairman, Structural Division Subcommittee for Study of Plate Girders; and Maurice N. Quade, Member, Executive Committee, Structural Division

9:30 **Non-Uniform Torsion of Plate Girders**

G. G. KUBO, A.M. ASCE, Associate Professor of Civil Engineering, New York University, University Heights, N.Y.; and B. G. JOHNSTON, M. ASCE, Professor of Structural Engineering, University of Michigan, Ann Arbor, Mich.

10:00 **Continuous Deep Beams**

DAVID H. CHENG, J.M. ASCE, Structural Engineer, the M. W. Kellogg Company, New York, N.Y.; and M. L. PEI, J.M. ASCE, Lecturer, City College of New York, N.Y.

10:30 **The Behavior of Continuous Structures Subjected to a Steady Forced Vibration**

C. T. G. LOONEY, A.M. ASCE, Assistant Professor of Civil Engineering, Yale University, New Haven, Conn.

Highway Division

9:30 a.m. **West Room**

Presiding: Edmund R. Ricker, A.M. ASCE, Traffic Engineer, New Jersey Turnpike Authority, New Brunswick, N.J.

The Garden State Parkway—Symposium

9:30 Planning the Parkway—Design Standard and Construction

COL. W. L. BRAYBROOKE, Assistant Chief Engineer, N. J. Highway Authority, New Brunswick, N.J.

10:00 Traffic and Revenue Studies

SAMUEL P. BROWN, Partner, Coverdale & Colpitts, New York, N.Y.

10:30 Special Features

EUGENE MACDONALD, M. ASCE, Partner, Parsons, Brinckerhoff, Hall & Macdonald, New York, N.Y.

THURSDAY AFTERNOON

JUNE 17

Hydraulics Division

2:00 p.m. **West Room**

Presiding: W. M. Lansford, Member, Executive Committee, Hydraulics Division; and Carl F. Izzard, A.M. ASCE, Chief, Hydraulics Branch, U.S. Bureau of Public Roads, Washington, D.C.

2:00 Highways, Hydrology and Hydraulics

E. E. DITTBRENNER, Hydraulics Engineer, Bureau of Public Roads, Albany, N.Y.

2:30 Highway Hydrology Discussion

G. R. WILLIAMS, A.M. ASCE, Associate Professor, Department of Civil and Sanitary Engineering, Massachusetts Institute of Technology, Cambridge, Mass.

3:00 Highway Hydraulics Discussion

R. W. CARTER, A. M. ASCE, Hydraulic Engineer, U. S. Geological Survey, Atlanta, Ga.

3:30 Open-meeting discussion

Sanitary Engineering Division

2:00 p.m. **Viking Room**

Presiding: Arthur J. Fox, Jr., Member, Programs and Publications Committee, Sanitary Engineering Division

2:00 Current Garbage and Refuse Program of N.J. Dept. of Health

ALFRED H. FLETCHER, Director, Bureau of Environmental Sanitation, N. J. Dept. of Health, Trenton, N. J.

2:30 Causes and Effects of Air Pollution Over Industrial Northern New Jersey

W. A. MUNROE, Bureau of Adult and Industrial Health, N. J. Dept. of Health, Trenton, N.J.

3:00 Effect of Pleasure-Craft Waste Discharge on a Small Harbor

WILLIAM T. INGRAM, A.M. ASCE, Associate Professor of Public Health Engineering, New York University, New York, N.Y.; and ALEXANDER N. DIACHISHIN, J.M. ASCE, Principal Engineer, Interstate Sanitation Commission, New York, N.Y.

Construction Division

2:00 p.m. **Rutland Room**

Presiding: Arthur E. Poole, Chairman, Executive Committee, Construction Division; and Warren Riker, Chairman of the Division's Committee on Programs at Technical Sessions

The Cable-Stiffened Suspension Bridge—Symposium

2:00 Design and Construction of San Marcos Bridge in El Salvador, Central America.

MODERATOR, BLAIR BIRDSALL, M. ASCE, Chief Engineer, Bridge Division, John A. Roebling's Sons Corp., Trenton, N.J.

2:15 Design of Superstructure

NORMAN J. SOLLENBERGER, A. M. ASCE, Associate Professor, Civil Engineering, Princeton University, Princeton, N.J.

2:45 Unusual Dewatering Problems

BYRON J. PRUGH, A.M. ASCE, Assistant Chief Engineer, Moretrench Corp., New York, N.Y.

3:15 Erecting the Cables

HAROLD W. HILLS, Staff Engineer, John A. Roebling's Sons Corp.

3:45 Erecting and Adjusting the Suspended Structure

JOHN E. NIXON, Engineer, John A. Roebling's Sons Corp.

CLAMBAKE

Thursday, June 17

7:00 p.m. **Atlantic City Country Club**

Busses will leave the front entrance of Haddon Hall at 6:00 p.m.

Price $4.00 per plate. Tickets for this event must be purchased before 4:00 p.m., Thursday.

Air Transport Division

2:00 p.m. **Venice Room**

Presiding: T. J. Owens, M. ASCE, Automotive Safety Foundation, Washington, D.C.

2:00 Design of Philadelphia Airport Terminal Building

J. ROY CARROLL, JR., Carroll, Grisdale & Van Alen, Architects, Philadelphia, Pa.

2:30 Economic and Operation Problems at Philadelphia International Airport

LOUIS R. INWOOD, Director of Aviation, City of Philadelphia, Pa.

3:00 General Design and Construction of Philadelphia International Airport

SAMUEL S. BAXTER, M. ASCE, Water Commissioner, City of Philadelphia, Pa.

FRIDAY MORNING

JUNE 18

Highway Division

9:30 a.m. **West Room**

Presiding: Roy E. Jorgensen, M. ASCE, Engineering Counsel, National Highway User Conference, Washington, D.C.

9:30 Traffic Diversion to Toll Roads

10:00 Construction of U. S. 1 Across New Haven Harbor

ERNEST PERKINS, Connecticut Highway Department, New Haven, Conn.

10:30 Maintenance by Contract

SYLVESTER E. RIDGE, M. ASCE, Chief, Maintenance Control Section, Construction and Maintenance Div., U. S. Bureau of Public Roads, Washington, D.C.

Soil Mechanics and Foundations Division

9:30 a.m. **Viking Room**

Presiding: Neville C. Courtney, Chairman of Foundation Committee, Philadelphia Section, ASCE

9:30 Foundation Problems of Eklutna Project, Alaska

WILLIAM R. JUDD, A.M. ASCE, Engineering Geologist, Bureau of Reclamation, Denver, Colo.

10:15 Classification of Rock Material in Respect to Weathering for Design of Excavation Back Slopes on West Virginia Turnpike

JOHN D. WELCH, J. M. ASCE, Soils Engineer, Howard, Needles, Tammen & Bergendoff, New York, N.Y.

10:45 Suction Force in Soils upon Freezing

ALFREDS R. JUMIKIS, M. ASCE, Associate Professor of Civil Engineering, Rutgers University, New Brunswick, N.J.

11:15 Prepared discussion

HANS F. WINTERKORN, A.M. ASCE, Princeton University, Princeton, N.J.

11:30 General discussion

Structural Division

9:30 a.m. **Rutland Room**

Symposium on Selected Structures Used in Atomic Energy Program

Presiding: Jewell M. Garrelts, Secretary, Executive Committee, Structural Division

9:30 Engineering for Radioisotopes

Twenty-minute moving picture illustrating various design features

9:50 An Engineering Approach to Hot-Cell Design

H. M. Glen, A.M. ASCE, Supervising Structural Design Engineer, Oak Ridge National Laboratory, Oak Ridge, Tenn.

10:20 Shielding Structure Facilities for Atomic Energy Research

FRANK RING, JR., Superintendent of Design, Oak Ridge National Laboratory, Oak Ridge, Tenn.

10:50 An Engineering Approach to Hot Laboratory Design

GINSON MORRIS, Chief Engineer, Oak Ridge National Laboratory, Oak Ridge, Tenn.

LADIES ENTERTAINMENT

Ladies Headquarters: Card Room **Haddon Hall**

The ladies headquarters will be the starting point of all events. It will be open from 9:00 a.m. to 5:00 p.m. Tuesday through Thursday, and 9:00 a.m. to 12:00 noon of Friday. Hostesses will be there to assist you.

Tuesday, June 15

11:30 a.m. Ladies Luncheon and Bridge

At the Atlantic City Country Club. Busses will leave the automobile entrance at 11:30 a.m. and return to the hotel about 5:00 p.m.

Wednesday, June 16

12:30 p.m. Luncheon, Carolina Room, Chalfonte Hotel

All ladies are urged to join their escorts in attending the luncheon at which the Governor of New Jersey, Hon. Robert B. Meyner, will be the honored guest and speaker.

7:30 p.m. Dinner, Vernon Room

Convention dinner and dance with special entertainment featuring the Hon. Con McCole, raconteur. Don't miss this.

Thursday, June 17

10:00 a.m. to 4:00 p.m. Boat ride

All-day boat ride around the island on which Atlantic City is located. Ladies will go ashore for luncheon after which they will return to the boat for the completion of the tour. Busses will leave from the automobile entrance of the hotel at 10:00 a.m. and will return the ladies to the same point about 4:00 p.m.

7:00 p.m. Clambake

The clambake at the Atlantic City Country Club will be one of the outstanding events of the Convention. Special arrangements are being made to make this unusual affair a success come rain or shine and for young and old.

Busses will leave from the automobile entrance of the hotel at 6:00 p.m. and return after the party.

STUDENT CHAPTER MEMBERS

Because the dates of the Atlantic City Convention preclude large-scale attendance by members of ASCE Student Chapters, no full program of student activities has been scheduled. Student Chapter members who can attend are invited cordially to attend and participate in all events of the Convention.

CONVENTION OFFICE AND PRESS ROOM

Open Saturday, June 12, to Friday, June 18

For the convenience of the technical press, newspapers and radio, a press room will be open throughout the days of the Convention. Members of the Public Relations Committee will be on hand to provide information.

INSPECTION TRIP

Thursday Afternoon, June 17

An excursion to points of interest on the Garden State Parkway which is now under construction. Busses will leave the automobile entrance of Haddon Hall at 2:00 p.m. and return to the hotel about 4:30 p.m. Price $1.00 per person. Tickets for this event must be purchased before 12:00 noon, Thursday.

TO THE GOLFERS

Golf enthusiasts, ladies or gentlemen, will be privileged to enjoy the facilities of the Atlantic City Country Club without cost during the Convention. Further details may be obtained at the Convention's information headquarters.

HOTEL RESERVATIONS

Headquarters for the Convention will be at the Haddon Hall Hotel. Requests for reservations will be handled chronologically and you are urged to send in your reservation request as soon as possible. It is suggested that you use the blanks on page 109 for this purpose.

ATLANTIC CITY CONVENTION COMMITTEES

General Convention Committee
Oliver W. Hartwell, *General Chairman*
Samuel S. Baxter, *Vice Chairman*
Everett G. Miller, *Secretary*
Neville C. Courtney, *Treasurer*

Entertainment
Joseph R. Farrell, *Chairman*

Excursion
Thomas Buckley, Charles M. Noble } *Co-chairmen*

Finance
Alexander Foster, Jr., *Chairman*

Hotel Arrangements
Ralph Earle, *Chairman*

Ladies Activities
Mrs. Samuel S. Baxter, *Chairman*

Local Sections Cooperation
Charles A. Howland, *Chairman*

Public Relations
James H. Allen, *Chairman*

Reception
William Padlasky, *Chairman*

Registration
Harry J. Engel, *Chairman*

Technical Program
Samuel T. Carpenter, *Chairman*

48 miles of CONCRETE PIPE assure adequate water supply for Savannah River Project

Producing materials for both A and H bombs at the Savannah River Plant in South Carolina requires enormous quantities of water. This water, from the Savannah River, is carried in concrete pipe lines to two pump houses, then distributed by other concrete pipe through the 315 square-mile plant site. From the pump houses the shortest line is 29,834 ft., the longest 62,419 ft. The system required 48 miles of concrete pipe.

Extremely difficult engineering problems were encountered in building this project because of the high water table in the entire area. Complete wellpoint systems had to be installed on every line as shown in the photograph. Many lines were laid in swamps and under creeks and railroads.

Whether the water line you plan is to be long or short, concrete pipe offers you the rugged strength, the long life and the economy necessary for satisfactory service. Its tight joints and dense structure prevent leakage and infiltration.

Because durable concrete pipe is not subject to damaging internal corrosion, it will maintain constant hydraulic efficiency. And it delivers long years of dependable, ***low-annual-cost*** service.

CONCRETE PIPE USED IN SAVANNAH RIVER PROJECT			
48"	410 ft.	66"	65,225 ft.
54"	5,250 ft.	72"	23,178 ft.
60"	28,493 ft.	78"	30,472 ft.
		84"	100,529 ft.

PORTLAND CEMENT ASSOCIATION

33 WEST GRAND AVENUE, CHICAGO 10, ILLINOIS

A national organization to improve and extend the uses of portland cement and concrete through scientific research and engineering field work

SOCIETY NEWS

A Hard Look at Engineering Ethics

MASON G. LOCKWOOD, VICE-PRESIDENT, ASCE Houston, Tex.

In recent years, and particularly in the past few months, there has been greatly increased discussion of engineering ethics. The recent incident of competitive bidding on a price basis for professional service, which set off the current controversy, serves to emphasize further the need for critical reexamination of our Code of Ethics to see if it measures up to the requirements of this day and time.

From such an examination of our system of engineering ethics, I have come to the conclusion that our entire set of moral and professional principles is fundamentally sound. The Code of Ethics is absolutely essential to the public interest. It is equally necessary to the welfare of the profession. It is not in any important sense outmoded. It is no more discriminative, restrictive, or monopolistic than any other body of necessary voluntary or involuntary regulations conceived in a genuine community interest.

Remarkable strides have been made in recent years in securing widespread understanding and acceptance of the Code, both within the profession and without. Notable in this respect are the advances made in getting public bodies to outlaw competitive price bidding for engineering services as bad public policy. Curiously this is only one of the ten items in the ASCE Code now under attack.

Defects in our system of ethics are not in the Code, but in our failure to enforce it properly. Enforcement difficulties characterize all such systems of voluntary controls. This is because disciplinary procedures in justice must be methodical, painstaking, and cautious. On the other hand, punitive measures are characteristically ineffective in all forms of control unless they are administered swiftly and surely. Our Society in some measure is at fault in this respect. By more aggressive attention to the matter, it could act more quickly and more certainly than it has in the past, without sacrifice of any principles of American justice.

One discernible defect in the Code, perhaps minor in its effects, is its obvious preoccupation with the field of private practice, where probably not more than 10 percent of the membership is to be found. The emphasis should be shifted deliberately in subsequent Code modifications, so that this documentary pattern for professional life will be of more individual significance to the large body of engineers not now being properly reached.

Our Code is founded on the proposition that the first consideration in all its principles must be the public welfare. No feature of any such professional code can contravene the general welfare and survive, however great the professional benefits might appear to be.

(This item is abstracted from an address given by Mr. Lockwood at a recent meeting of the Hawaii Section.)

Ballots for Dues Increase Mailed

In carrying out the unanimous vote of members attending the general business meeting of the Society in Atlanta, ballots for changing the constitution to provide for an increase in annual dues were mailed on May 5 to all members in good standing. The proposed amendment, if carried by two-thirds of the members voting, will increase annual dues to $25 for Members, Associate Members, and Affiliates, and to $15 for Junior Members. The proposed amounts apply to all members regardless of residence.

With the ballot, members are receiving a statement prepared by a committee of members setting forth the economic reasons behind the pressing need for additional income from this source. Present dues were established in 1921 when $1.00 would buy paper, printing, and services that today cost $3.00. In spite of the big increase in membership over the past 33 years, plus maximum operating economies and higher advertising income, services to members cannot be maintained even at a reasonable level without more income from dues. Increased income provided by the proposed raise in dues would amount to about $150,000 a year—15 percent of the current budget. This income is required to assure continuation of services on the present level and, in addition, to provide for moderate improvement in these services.

Neither the present President nor the current Board of Direction can commit next year's officers on how the funds of

Atlantic City Convention Social Program Features Clambake

This is a ticker to call special attention to the clambake—at the Atlantic City Country Club on Thursday evening, June 17—which will be one of the outstanding events of the Atlantic City Convention. Special arrangements are being made to assure the success of this unusual affair, come rain or shine. Men skilled in the art of making clambakes have been engaged to prepare and serve this feast, which will delight gourmets. Lobsters will be flown down from Maine to assure their being fresh, sweet, and juicy. Corn-on-the-cob will be flown from the South. Clams will come from Long Island, and oysters from Maurice River and Chincoteague. These will be augmented by fresh-killed Jersey broilers, and the whole succulent meal roasted in heated ovens in a specially prepared pit. Oyster and clam bars will serve these tasty morsels fresh from their ocean beds. No one will count how many you eat, nor will there be any limit on the beer. An old-fashioned German band will play your favorite melodies, and you will be encouraged to sing. The Country Club has made both the golf course and the pitch-and-putt course available to ASCE members so you will have a chance to work up an appetite. The Philadelphia Section will be your host, or the tickets would cost more than double the $4 you will be paying.

the Society will be spent next year. Decision on the budget for each year rests with the Board of Direction for that year.

If the dues amendment is defeated, it is unlikely that next year's Board of Direction would approve another deficit-financing budget as it did in 1954. A vote disapproving the increase in dues would be a clear indication to the Board of Direction that the members of the Society expect its management to give the best service it can with the old income, even if it is based on 1921 dollars.

The Board of Direction, which represents directly the electorate in all our Districts, certainly would follow the wishes of members. If Society income is not increased by additional dues and if the Board declines to continue deficit financing, the Board would probably be compelled to reduce all activities and thereby reduce expenses. The Society has no appendage operations that could be lopped off. Reduction of income would require reduction in all Society operations.

It is important for members to support the proposed amendment so that the Society can continue as a major force in developing and advancing their profession of civil engineering in all its phases. It is important that each member vote.

Handbook of ASCE Local Section Operations Issued

Latest addition to the growing list of handbooks prepared for the assistance of ASCE members is the 1954 edition of the *Handbook of Local Section Operations*—a $5^1/_2 \times 8^1/_2$-in., 40-page photo-offset pamphlet—which has been adopted as rules of procedure for Local Sections by the Board of Direction. The primary purpose of the handbook is to help Local Section officers to perform better as leaders of this important ASCE activity, and a copy has been placed in the hands of every Section officer. However, a limited number of copies are available to interested members of Local Sections on request to the Executive Secretary.

The handbook contains fairly complete information on Local Section organization and the rules of procedure. It also includes a valuable check list of suggestions for promoting professionally and technically useful and satisfying programs of local activity.

Similar handbooks have been issued in the past two years as guides to Technical Division and Student Chapter activities, and a limited number of these handbooks are also available on request.

Collective Opinion of Members on Collective Bargaining

Observations, Conclusions and Recommendations of ASCE Committee on Employment Conditions

James I. Ballard, *Chairman*
Charles W. Yoder, *Vice-Chairman*
Paul M. Wentworth
Mauno Backlond
Sterling S. Green
Charles W. Okey
I. C. Steele, *Contact Member*

This interim report dated March 28, 1954, is confined to current considerations by the Committee of the factual material developed by its mail-questionnaire survey, conducted in the fall of 1953, the results of which were published in CIVIL ENGINEERING for November 1953.

Facts, not prejudices or emotions, should be the basis for any consideration of unionism and its encroachment on professional engineers. Individuals tend to talk in terms of personal opinion and reactions influenced by such factors as the part of the country the engineer is from, the background of his employment, and possibly his age. Nor does the Committee wish to impress members of the Society with the fact that it has suddenly discovered collective bargaining and unionism. It is well known that the matter has been under active consideration by ASCE for years.

Unionism in engineering is a very complex subject. It gets more confusing as it is probed with an open mind. The only members who appear to have positive answers are those who are uninformed on today's developments, or those who confuse the science of engineering with the profession. The few selected opinions that follow show the completely opposed points of view that have developed. From engineers in opposition are these excerpts:

1. "A union has no place in a professional group. One's ability should guide his success—not a union."
2. "An engineer should bargain as an individual for his worth, not as a member of a group."
3. "I have always felt (even during the worst of the depression) that I could keep my head higher than a common level by my own individual efforts. Every engineer ought to feel the same."
4. "Collective bargaining is like dope, causing a false sense of well being. It makes one a slave to manipulators of human woes."
5. "Collective bargaining would seriously hinder any advancement of the engineering profession toward true professional status. In time, it would relegate engineers to the level of tradesmen."

And here are an equal number of favorable opinions:

1. "ASCE should take a more active part in securing economic benefits for civil engineers."
2. "Until we get somebody who will fight for some sort of recognition for the engineer we are doomed to remain in our semi-mediocre positions as workhorses with brains without just compensation."
3. "We have leaned on our mythical 'professional status' until my white collars are badly frayed. I want economic status, too."
4. "If engineers were equitably compensated, relative to others, there would be no need for collective bargaining. In certain cases there seems to be no alternative."
5. "I am deeply concerned with the salary scale of engineers and believe that unless engineering societies take an active part in correcting such, sooner or later the engineering profession will be unionized, and the fault will be that too many of us in positions of authority have been dilatory in meeting the problem."

All civil engineers, the Committee agrees, want to be considered professional men, with all that the term means and implies. Regardless of our desires, however, an unrealistic approach to the subject will lead to false conclusions and ultimate frustration. We must consider our profession as it exists today,

The ten marked states reported 60 percent of the sentiment favoring collective bargaining for professional engineers. Percentage figure in marked states represents that portion of the national total of sentiment favoring collective bargaining in that state.

not as we wish it were, or as it existed generations ago.

Our profession, like other professions, is in a state of evolution. Fixed values are hard to establish. Rather, it is important to maintain a flexible approach to any study of the subject. Attitudes and actions of the Society must be modified, if necessary, to meet changing conditions.

Quoting from the Constitution of ASCE, "The objective of the Society shall be the advancement of the science and profession of engineering." There is something substantial and permanent about the science of engineering—two and two always add up to four. As to the "profession to engineering," it was one thing when the Society was founded, it was something else a generation ago, it is still different today, and who can tell of the future.

Such an unstable base tends to bother the engineering mind, which clings strongly to fixed values. When we realize that the future of the profession is being influenced by factors of social evolution and the humanities, it becomes evident that no fixed approach is possible, at least to this one problem.

Speaking of being realistic, what did the committee decide is the one unmistakable factor that is stimulating the growing interest of civil engineers in collective bargaining? It is MONEY. If every young engineer out in the field today were making as much money as the "catskinner," the Committee on Employment Conditions could leave this problem and move on to the next item on its agenda. In other words, too many Junior Members in their first few years want all the ego-satisfying recognition that goes with their concept of professional status and at the same time have compensation while they are in training equal to that of a top-level craftsman. This is another of the many factors that impinge on this consideration of unionism vs. professionalism.

Results of the Survey Observed

Replies from more than 53 percent of the Society's membership in the United States and its territories indicate the extraordinary interest in the subject under examination by the questionnaire. Both the volume and the distribution of the replies insure a reliable cross-section of member opinion. That further reliability can be placed in the responses is evidenced by the fact that the returns are in proper proportion to corresponding figures for (*a*) various membership grades, (*b*) age groups, and (*c*) geographical distribution.

It is extremely significant that two out of every five of the 17,203 respondents are *not* opposed to collective bargaining. By grades of membership, nearly one-half of the Junior Members, one third of the Associate Members, and one-fourth of the Members are not opposed to collective bargaining.

As might be expected, "incompatibility with professional status" is the overwhelming objection to the acceptance of collective bargaining. Of those who replied, 25 percent considered collective bargaining to be to their advantage, and 96 percent of these preferred representation by a professional employees bargaining group. Only 4 percent wished to be represented by craft or labor union representation.

The breakdown of answers by age groups closely parallels the answers tabulated according to membership grades.

If the number of respondents, 625, who stated that they are now members of employee representation groups, is extended to include the entire membership of the Society in the United States, about 1,180 belong to such groups. Analysis of titles of these employee groups shows that 410 of the respondents belong to established collective bargaining organizations. The others belong to mutual benefit associations of the type common among large groups of Civil Service employees.

A separate analysis of answers to Question 8, 9, and 10 in relation to classifications established in Question 6 indicate that opposition to collective bargaining is highest among those in private practice and lowest among those in government service. The same relationship holds for opinion on the advantages of collective bargaining (No. 9), that is, minimum acceptance by those in government service. Likewise, only 1 percent of those in private practice belong to bargaining groups, as compared to 7 percent of those in governmental service. In every case those in "Industry" and in "Education" were somewhere between these extremes.

Finally the Committee noted that 76 percent of the members who replied are either registered engineers or engineers in training. Stated another way, three out of four members of ASCE have attained, or are in the process of attaining, professional status as defined by the laws of the states.

Conclusions

It is impossible for the Committee to dismiss lightly the fact that about 40 percent of the members of the Society have no objection to collective bargaining and that 25 percent believe that it would be to their advantage. Among the Junior Members, the group which will provide the future leadership of the Society, these percentages are even higher. The Committee believes, but without firm evidence, that approval of collective bargaining by the membership has been increasing during recent years. Acceptance is particularly notable among Junior Members who compare their incomes with those of skilled labor or craftsmen; among Junior Members and younger Associate Members (30 to 40 years of age) who generally are not receiving salaries commensurate with their years of experience, or with today's starting salaries for Junior Members; and among members in all grades who work in large organizations, governmental or industrial, where the number of professional and pre-professional employees precludes individual contact with top management.

There is a growing desire for concerted action among these three groups of members, looking toward their own financial betterment. The attitudes expressed in several hundred letters and comments from respondents are indicated by the excerpts quoted earlier in this report.

The Committee is well aware of the strict limitations—legal as well as those of precedent—that make it extremely difficult for the Board of Direction to take positive steps in line with the attitudes of those favoring collective bargaining. It is also aware of the small segment of membership that prefers that the Society does not engage in matters relating to the economic welfare of its members.

Taft-Hartley Act Adequate

It was felt by the Committee that the present provisions of the Taft-Hartley Act assure adequate protection for both professional and pre-professional engineers against being forced into unions at the craft or technical level. However, it must be emphasized that the protection afforded by the Act, although adequate, is *not automatic*. Positive counter-measures must be taken by the engineering group so threatened. Professional engineers, including those in training, are required to take positive action in accordance with established and fairly complex legal and administrative procedures. The basic moves required to form a collective bargaining group at the professional level are well stated in the recent Society memorandum, "Engineers, Unionization and the Tax Status of ASCE." This memorandum should be consulted by members who are forced to consider taking such steps.

Recommendations

Based on the foregoing conclusions, which were the result of the thoughtful deliberations of the full Committee, the following recommendations have been made to the Board of Direction.

1. Growing encroachment by labor unions on both professional and pre-professional engineering employees indicates

an increasing number of circumstances where the provisions of the Taft-Hartley Act do not apply.

2. Growing economic pressures have caused 25 percent of the respondents to the survey to state that collective bargaining is or would be advantageous to them. Also 96 percent of this group expressed a preference for collective bargaining representation by a professional employee group.

Therefore, the Committee recognizes an imperative need for the Society to provide vigorous leadership looking toward the solution of the related problems confronting a large number of its members.

The Committee recommends that the Board re-affirm its policy of 1946, which states that:

"(1) Any group of professional employees, who have a community of interest and who wish to bargain collectively, should be guaranteed the right to form and administer their own bargaining unit and be permitted free choice of their representatives to negotiate with their employer.

"(2) No professional employee, or group of employees, desiring to undertake collective bargaining with an employer, should be forced to affiliate with, or become members of, any bargaining group which includes non-professional employees, or to submit to representation by such a group or its designated agents.

"(3) No professional employee should be forced, against his desires, to join any organization as a condition of his employment, or to sacrifice his right to individual personal relations with his employer in matters of employment conditions."

That statement was adopted by Engineers Joint Council as its official policy. It is the policy on which the "professional employee" provisions of the Taft-Hartley Act were based.

The Committee heartily approves the release of the memorandum "Engineers, Unionization and the Tax Status of ASCE," as the first step in acquainting the membership of the Society with basic information on this general subject, and recommends that it be supplemented by additional measures. In the light of new evidence of craft union encroachment, the Board was urged to provide, as promptly as possible, detailed information to the membership relative to courses of action available to them: (1) in cases where the Taft-Hartley Act applies, and (2) in cases beyond the coverage of the Taft-Hartley Act, where state laws apply, with special attention to those states where the need is greatest.

The Committee requested the appropriation of necessary funds to expedite these recommendations as early as possible.

Lillian Gilbreth Receives Washington Award

Lillian Moller Gilbreth receives the Washington Award at a dinner meeting in Chicago on April 8. The first woman to receive the award in its 35-year history, Dr. Gilbreth was cited "for her outstanding contributions to engineering and scientific management, and for her unselfish devotion to the problems of the handicapped." She is president of Gilbreth, Inc., consulting management engineering firm of Montclair, N. J., and internationally known as an engineer, author, educator, humanitarian, lecturer, and counsellor. The Washington Award is administered by the Western Society of Engineers on recommendation of the Founder Societies. It is given for accomplishments that "promote the happiness, comfort, and well being of humanity."

New Freeman Fund Fellowship Is Open

Opportunity for research in hydraulics or related fields is available to a qualified applicant of the ASCE or the ASME through an award from the Freeman Fund, which offers financial support in the form of fellowships and scholarships. The fund was established by an outstanding hydraulic engineer, the late John R. Freeman, to aid and encourage young engineers to make hydraulic investigations and to undertake hydraulic research. Since Mr. Freeman was president of both ASCE and ASME, it is particularly fitting that members of both societies be eligible for such aid and encouragement.

Notice is hereby given, well in advance of the closing date for submission of applications, of the rules established in connection with applications for the award. The rules follow:

1. Applicants must be citizens of the United States and members in some grade of either of the two cooperating societies, ASCE and ASME.

2. Applications must be submitted to the Freeman Fund Committee, care of the Executive Secretary, ASCE, 33 West 39th Street, New York 18, N.Y., on or before February 1, 1955. Announcement of the award will be made on *March 15, 1955*.

3. Applicants must tender a program of study, investigation, or research in related subjects, covering a period of at least nine months starting *in 1955*, together with a statement of funds needed.

4. Applicants must furnish evidence of qualification to carry out the proposed program.

5. The Freeman Award Committee will give preference to projects bearing importantly on the defense effort.

Though $1,200 is the usual grant to a winning candidate, the next award can be as much as $3,000, depending on the need claimed in the application.

Mr. Freeman endowed a similar award with the Boston Society of Civil Engineers, which currently has available a stipend of $3,500 for a single man and $4,200 for a married man. Preference will be given to residents of New England and eastern New York north of the city. Applications, addressed to the Freeman Fund Committee, Boston Society of Civil Engineers, 88 Tremont Street, Boston 8, Mass., must be received by July 1, 1954.

EJC Annual Report For 1953 Available

Engineers wanting to know more about Engineers Joint Council will be interested in its recently issued 1953 Annual Report. The 30-page booklet summarizes 1953 activities; states the problems coming within the purview of EJC; and gives the constitution, 1954 committees, and a directory of representatives.

Inquiries concerning the report should be addressed to Engineers Joint Council, 29 West 39th Street, New York 18, N.Y.

Collective Bargaining Requires Group Action

For some time there have been instances in different parts of the country of the International Union of Operating Engineers' forcing young professional engineers on construction projects to become members of that union. Generally this has been accomplished by pressure methods against the wishes of both the employees and the employers.

An acute situation of this kind has arisen in connection with the construction of the Ohio Turnpike. The IUOE has created a Local Union 18 C, designated as Technical and Professional Engineers, which construction men are being forced to join.

It is customary practice for IUOE officials in Ohio to go to a contractor on highway work and request his simultaneous signature on two agreements—one with Local 18 to cover operators for his construction equipment and the other with Local 18C to cover his field engineers. It has happened that unless the contractor signed the latter agreement, too, he found his job promptly closed down. Even though the contractor may wish to have nothing to do with Local 18 C, he is faced with delay to his job—even damage to his equipment—unless he capitulates, rather than fight the cause of a few of his young engineer employees. In several instances, the contractor's employees reluctantly have signed with the union rather than lose their jobs.

Terry and Wright, Inc., contractors on several miles of the Turnpike near Wauseon, between Toledo and the Indiana state line, refused on December 3, 1953, to sign a contract with Local 18 to employ only field engineers who were members of the Operators Union. The job was struck immediately.

At that time, L. Stewart McCoy, J.M. ASCE, a field engineer employed by Terry and Wright, refused to join Local 18 C and so advised his employer in spite of the employer's offer to pay Mr. McCoy's union fees and dues. He stated that if he had to join IUOE to work he would seek other employment.

About a week later Terry and Wright's operations were permitted to proceed after agreements had been made with IUOE providing among other things that Mr. McCoy must refrain from setting stakes or using surveying equipment in the field until the situation was cleared up. He is still an office engineer and the contractor's men are working.

Mr. McCoy immediately sought advice from the Toledo Section of ASCE and the Ohio Society of Professional Engineers. ASCE Assistant Secretary E. L. Chandler discussed the problem with members at a Toledo Section meeting on December 9. During and since his subsequent visits to Toledo, Columbus and Cleveland, ASCE has advised on actions open to engineers who may have been coerced into joining the International Union of Operating Engineer's Local 18 C.

Courses of action recommended include (1) the organization of a professional employee bargaining group which could become the representative of these employees in dealing with their employers; (2) group action on the part of professional employees who have been taken into the labor union which would lead to getting them out through decertification; (3) action against IUOE on the basis of unfair labor practices in the Terry and Wright case; and (4) court action under the laws of the State of Ohio instead of under the jurisdiction of the NLRB.

Both the first and second courses recommended require *group* action. Action by an individual would be ineffective even though each individual might wish to have full freedom to follow his own desires. As the term "collective bargaining" implies, labor laws have been written to provide for collective action. Individual employees, professional and non-professional, are governed by majority vote of those in an appropriately formed group with which they may be associated. Unless group action is taken by professionals, the individual professional is vulnerable whenever a non-professional organization takes over and claims him. After the professional group is formed it may decide by majority vote, to bargain collectively or not to do so.

Questionnaire on Employment Conditions, 1953, Analyzed

Responses to the "Questionnaire on Employment Conditions, 1953" to the number of 17,203 were summarized mechanically by I.B.M. machines, and the results were published in CIVIL ENGINEERING for November 1953 (page 75). Subsequently letters of comment from members suggested the following further analyses of the returns by cross-referencing Question No. 3 with Questions Nos. 8 and 9.

Question No. 3 called for an indication of the respondent's employment status. Question No. 8 requested information as to whether the respondent is or is not "opposed to collective bargaining." Question No. 9 read, "Do you consider that collective bargaining is, or would be advantageous to you?"

An analysis of replies to Question No. 8, broken down according to employment status (No. 3), is given in Table I.

When replies to Question No. 9 were analyzed, according to employment status (No. 3), the results given in Table II were obtained:

A review, discussion, and interpretation of all the information obtained from the survey, prepared by the Society's Committee on Employment Conditions, was presented to the Board of Direction at its Atlanta meeting, and the broader aspects of the subject were presented at the general session of the Convention by the chairman of the Committee, James I. Ballard. The Committee's interim report, brought up to date as of March 28, is presented in somewhat shortened form elsewhere in this issue.

TABLE I. Analysis of Replies to Question No. 8

Employment Status	Opposed		Not Opposed		Total
	No.	%	No.	%	
Employer	1,950	79	524	21	2,474
Supervisor	4,219	66	2,141	34	6,360
Non-supervisor	4,152	55	3,396	45	7,548
Total	10,321	61	6,061	39	16,382

TABLE II. Analysis of Replies to Question No. 9

Employment Status	Those Believing Collective Bargaining Advantageous to Them		Those Not Believing Collective Bargaining Advantageous to Them		Total
	No.	%	No.	%	
Employer	200	8	2,215	92	2,415
Supervisor	1,267	20	5,074	80	6,341
Non-supervisor	2,633	35	4,889	55	7,522
Total	4,100	25	12,178	75	16,278

Head table at the dinner, culminating feature of the first annual meeting of the New England Council, is shown here. Pictured, in usual order, are Don Reynolds, assistant to the Secretary of ASCE; Neal McDowell, Council president; ASCE President D. V. Terrell, who spoke on Society affairs; Mrs. John B. Wilbur; E. L. Cochrane, dean of engineering at MIT, who spoke on transportation; Dr. John B. Wilbur, president of the Northeastern Section; Mrs. McDowell; Frank A. Marston, ASCE Director for District 2; and Ernest L. Spencer, secretary of the Council and secretary-treasurer of the Northeastern Section.

New England Council Has Successful First Meeting

The first general meeting of members in the New England Council of Sections—held at Massachusetts Institute of Technology on March 20—constituted a notable addition to Society activity in that area. Well-chosen subjects and outstanding speakers attracted well over 200 members and their wives to the full-day calendar of events. Hosts were the Northeastern Section of ASCE and Massachusetts Institute of Technology. Arrangements for the meeting and all social events were coordinated by Prof. Ernest L. Spencer, secretary of the New England Council and secretary-treasurer of the Northeastern Section.

Under the chairmanship of Neal D. McDowell, the program offered four technical addresses and two of general professional interest. One technical session was devoted to a study of the water resources of New England. Howard M. Turner, past-president of the Northeastern Section, traced the effect of increases in federal income tax upon the increased cost of capital investments for hydro development. The trend is advantageous to construction of steam plants for new power, he said. Unusual planning and construction features of the Littleton (N. H.) hydroelectric plant were described by Thomas J. Rouner and David R. Campbell, vice-president and principal project engineer for the New England Power Co. A second session featured a paper on "Progress in Foundation Design on Soft Ground," by Arthur Casagrande, professor of soil mechanics and foundation engineering at Harvard University, and one on "Highway Financing" by Hal H. Hale, executive secretary of the American Association of State Highway Officials.

ASCE President Daniel V. Terrell was the luncheon meeting speaker, with a discussion of current endeavors and concerns of the Society and the relationship of ASCE to other professional groups. At the other social function of the day, a dinner meeting, E. L. Cochrane, dean of engineering at Massachusetts Institute of Technology, described the need for coordinating methods of transportation for both economy and national strength.

Society's Cost Control Manual Is Released

ASCE Manual No. 33, entitled *Cost Control and Accounting for Civil Engineers*, is now available. In preparation since early in 1952, the manual provides information on accounting practice with sufficient exploratory material to enable the engineer to help an accountant or bookkeeper initiate an accounting system best suited to the character of the work in which he expects to engage. While it does not propose to furnish information that would enable engineers to become accountants, it assumes that every engineer in private practice will want to "maintain accurate and complete records, indicating trends of his business beyond mere bookkeeping costs and earnings."

The manual is presented in four parts: (1) The records which the engineer and his technical force must keep in order to produce suitable accounting information; (2) what the bookkeeper does; (3) how the figures from the books may be set up and summarized for accounting purposes; and (4) examples of forms the engineer may use in setting up an accounting system in his office.

Manual No. 33 was prepared by the ASCE Committee on Private Engineering Practice (now the Committee on Professional Practice) and accepted by the Board of Direction at its Atlanta meeting. Copies may be purchased from Society headquarters (33 West 39th St., New York 18) at a list price of $1.50, with a 50 percent discount available to members.

Photogrammetric Award To R. E. Hagenhoff

Winner of the Bausch & Lomb Photogrammetric Award, presented for the first time this year, is Robert E. Hagenhoff, a recent engineering graduate of the University of Cincinnati, and an active Student Chapter member. The prize, consisting of $100 in cash, a three-year membership in the American Society of Photogrammetry, and an all-expense trip to the society's recent annual Washington meeting, was presented to Mr. Hagenhoff for his senior-year thesis entitled "A Photogrammetric Mapping Project for Middletown, Ohio." Mr. Hagenhoff is now employed by Armco Drainage and Metal Products, Inc., Middletown.

Society Jewelery for Sale

Society jewelry now includes a Tie Clasp and Tie Chain. The former consists of the lapel-type emblem mounted on a tie clasp. Both are gold plated. The

These two types of Society jewelry—the Tie Clasp (lower photo) and Tie Chain—are convenient to wear and popular.

Tie Clasp is priced at $4.50, plus 10 percent federal tax, making a total of $4.95. The 14-k gold badge is available in the form of a watch charm attached to a gold-plated tie chain at a cost of $8.50, plus 10 percent federal tax, a total of $9.35. The federal tax is not payable on export orders.

All necessary information required for ordering the Tie Clasp and Tie Chain, as well as other Society jewelry, is provided in a coupon on page 119.

Pipeline Constructors Meet at Midland, Tex.

Inaugurating a new ASCE program, representatives of major pipeline constructors, operators, and engineers met at Midland, Tex., April 9 and 10, to confer about subjects of mutual concern. Although much of the conference was devoted to organization, several papers were presented and discussed.

Two of the prepared discussions dealt with the surveys, often by photogrammetric methods, so important to the construction of pipelines. These were led by Earl K. Monteith, chief engineer for Studdert Engineers, Midland, and Jack Mitchell, of Lockwood, Kessler and Bartlett, New York. Another paper, presented by Walter H. Davidson, general superintendent of Transcontinental Pipe Line Corp., Houston, discussed the detailed provisions of the new edition of the ASA Code for Pressure Piping, and interpreted the significance the code will have for constructors and operators.

Orienting the new organization was an address by Eldon V. Hunt, Ebasco Services, New York. Mr. Hunt traced the development of pipelines as a major transport facility, enumerated current challenges facing the industry, and read the crystal ball a bit on future possibilities.

The Conference was arranged by Charles M. Davis, chairman, and Joseph B. Spangler, secretary, of the Pipeline Committee of the Construction Division. It was conducted as an integral part of the spring meeting of the Texas Section. On hand to assist with organization were ASCE President D. V. Terrell, Construction Division Chairman Arthur E. Poole, and Don P. Reynolds, assistant to the Secretary.

With the cooperation of several organizations interested in various phases of pipeline operation, additional conferences are being planned, for areas of major activity in this field of professional interest.

Engineering Registration Officials Meet in New Orleans

New Orleans was the locale of the March meeting of Southern Zone members of the National Council of State Boards of Engineering Examiners. The meeting was particularly honored by the presence of several old-time NCSBEE officers. Louisiana was the second state in the United States to require registration—1908. (Wyoming law was enacted in 1907.) Donald Derickson, Hon. M. ASCE, chairman of the Louisiana State Board for Professional Engineers and Land Surveyors, who was present, has served continuously on that Board since 1917, longer than any other member of a state board of engineering registration. Present, too, was Marcel Garsaud, M. ASCE, director of Industrial Facilities of the Port of New Orleans, who helped to organize NCSBEE in 1920 and served as its first president. T. Keith Legaré, M. ASCE, executive secretary of the Council since 1923, also has been a member and secretary of the South Carolina State Board of Engineering Examiners since 1922, and member and for several years chairman of ASCE's standing Committee on Registration of Engineers. These three men are life members of ASCE.

It is worthy of note that the earliest recorded thought in the publications of ASCE on the subject of determining the status of men practicing or holding themselves as competent to practice civil engineering, is found in the December 1901 TRANSACTIONS (Vol. XLVI) in the record of a discussion that took place at the annual convention of ASCE in 1901. PROCEEDINGS for January 1911 includes a draft of an "Act to Provide for the Licensing of Civil Engineers," drawn up at the request of the Board of Direction of the Society by a committee appointed for the purpose. In 1915 and again in 1919, a joint committee of six national engineering societies prepared new drafts of a law. In 1925, ASCE published and circulated widely a draft of a law prepared by its standing Committee on Registration of Engineers. In conference with other engineering societies, revisions were issued in 1927, 1929, 1932, 1937, 1943, and 1946. The latest (1946) revision of the Model Law for the Registration of Professional Engineers and Land Surveyors was approved and endorsed by ASCE, ASME, AAE, AIChE, NSPE, NCSBEE, AIEE, ASHVE, AIMME, IES, SNAME, AICE, and ASEE. This edition has been widely distributed. Copies may be obtained gratis on request from the Executive Secretary of ASCE.

Registration officials are photographed at New Orleans meeting of Southern Zone of NCSBEE. Shown, left to right are Donald Derickson, Hon. M. ASCE; Marcel Garsaud, M. ASCE; and T. Keith Legaré, M. ASCE, secretary of NCSBEE.

Where Should the Engineering Societies Center Be Located?

Representatives of the four Founder Societies and AIChE met in Chicago on April 6 to examine the sites currently offered in and near that city for consideration by the Societies for the location of a headquarters. City officials, businessmen, and the presidents of the three major universities in the Chicago area offered inducements to attract the engineers there. Illinois Institute of Technology has offered a block on its campus bounded by 31st and 32nd Streets lying between State and Dearborn. Architects for the Institute have prepared for consideration a sketch of a two-story modern structure on this site which they have estimated would cost $2,500,000. The University of Chicago, and Northwestern University in nearby Evanston, also have proposed definite sites.

Giving consideration to the Engineering Societies Library, which must be an integral part of an Engineering Center, wherever it is located, Chicago's Crerar Library has indicated that its own outgrown facilities must be expanded. It appears that the Crerar Library might be interested in joining with the Engineering Societies to form a single library or some type of cooperative venture. Any cooperative arrangement between the Crerar Library and the Engineering Societies Library would be to the advantage of the users of both and would make broader service possible to engineers at reduced costs.

The need for a new building for the headquarters of the Founder Societies has been evident for the past several years (CIVIL ENGINEERING, October 1953, page 70). United Engineering Trustees, which holds the title to the Engineering Societies Building at 33 West 39th St., New York, and operates it for ASCE, AIME, ASME, and AIEE, has estimated space requirements for a new building to be from 180,000 to 200,000 sq ft. This space would house the Founder Societies, the Library, and a number of associate societies which have indicated to UET that they would be interested in space in a new Engineering Societies Center Building.

There follows a summary of the March 16 report to the Engineers Joint Council Committee of Secretaries prepared on request of the Committee. The report was prepared by W. N. Carey, Executive Secretary of ASCE, and expresses his views.

Functions of an Engineering Center

When the present Engineering Societies Building was constructed nearly a half century ago, the owner Societies had a combined total membership of 15,000. Now, with the American Institute of Chemical Engineers, we total 156,000, with a combined staff of 350 people. In 1980 (26 years hence) these two items are estimated at 275,000 members and 500 staff. Fifty years ago the principal conventions were held in the Societies Building Now none of the conventions is held there. Use of major hotels is necessary to furnish convention facilities required, and no provision need be made for convention space in a new Engineering Societies Center.

Primarily the proposed center should be designed as an office building to house the staff (350 now and eventually about 500). Since the business of the Societies fundamentally is a mail-order business with members, the building could be located almost any place. All the business connected with membership, dues, accounts, technical publications, meetings, and all records necessary for membership corporations, could be carried on readily no matter where the building is located.

Space Requirements

Based on factors developed by authorities on office planning, the direct needs by the year 1980 would approach 140,000 sq ft for housing Society staff personnel; EJC; UET; ECPD; Engineering Societies Library; rooms for boards and committees; and space for lobby, stairs, and utility rooms. Of this, 30,000 sq ft would be available for rental now on a diminishing basis until about 1980. There is little doubt that the proposed new center would attract many tax-exempt associate organizations, to which space could be rented at inducive rates.

Why Manhattan?

Property values in New York are among the highest in the world. Probable land cost for a center in New York will be in the neighborhood of $1,000,000 in the mid-Manhattan area and around $400,000 in the loft districts or other similar localities on the island. Any Manhattan site will require a multi-story building estimated to cost at least $4,000,000 without land but including heating and air conditioning. The UET budget for operating and maintaining the Engineering Societies during 1954 is $244,650, with elevators alone costing $25,000 a year—an indication of the cost of maintaining and operating a multi-story building in New York.

When the coast-to-coast operations of the Societies, organized for the promotion of applied science and education, are considered, it is difficult to find justification for a New York address when weighed against the cost of a multi-story building that a Manhattan address dictates. The center of gravity of the present 156,000 membership has not been determined with accuracy, but available statistics indicate that it lies in central Illinois. Savings in travel costs for Society officers, members, committees, and staff personnel to and from a location near the center of membership would be considerable.

A two-story functional building without elevators with a gross area of 180,000 to 200,000 sq ft would require a plot of about 4 acres. It could be built for from 20 to 25 percent less than a multi-story building, perhaps for about $3,000,000, without land. Its operating and maintenance costs would be about 20 percent less than for a multi-story building.

According to the report, a multi-story building appears to be unjustified wherever located, and a mid-continent location for the Engineering Societies Center near a center of transportation is indicated.

Chicago Sites Considered

The Chicago site-inspection date of April 6 was set, and the group of Engineering Society representatives was assembled under the leadership of Elgin B. Robertson, president of AIEE. After the bus tour to sites at Northwestern at Evanston and to the campuses of Illinois Institute of Technology and the University of Chicago, AIEE was host at a dinner for about fifty of the visiting engineers.

The problem of a new Engineering Societies Center was discussed at length at the dinner. The group agreed that a special site-selection committee should be formed of the five men now presidents of the Societies there represented—ASCE, AIME, ASME, AIEE, and AIChE. The governing bodies of these Societies will be requested soon to authorize their respective presidents to serve on this important committee.

It is expected that the committee in cooperation with UET, will speed up the development of a definite recommendation for a location of the proposed center. Such a recommendation, when forthcoming, must be submitted to the governing bodies of the five Societies concerned for approval by each, before any definite commitments can be made.

FROM THE NATION'S CAPITAL

JOSEPH H. EHLERS, M. ASCE — Field Representative ASCE

Social Security Legislation

The Field Representative was requested to testify before the House Ways and Means Committee on behalf of the president of Engineers Joint Council with reference to the EJC position on the extension of Social Security coverage to self-employed engineers as proposed by the administration. Opinion among self-employed engineers is somewhat divided on this question. EJC took a position against compulsory coverage and in favor of voluntary coverage for self-employed professional men. Only a small proportion of engineers are self-employed—probably considerably less than 10 per cent of the EJC societies' membership.

Under the proposed law, a professional engineer on reaching age 65 would either have to stop working or lose his benefits until he reached age 75. During this extra ten-year period he would pay added Social Security taxes of $1,417.50.

The following is an excerpt from the testimony:

"The proposed law would pay such a professional man a premium (but not enough to live on) for *not* working after he reaches the age of 65, but if he continues on a self-employed basis it would not only postpone for ten years his eligibility for benefits, but would also impose an added burden by taxing him at a rate 50 percent higher than he paid when employed. The effect in encouraging idleness of professional engineers over 65 years of age, and penalizing those who continue to work, is manifestly contrary to the public interest, particularly in these days when the shortage of experienced professional engineers is acute."

Both in respect to those presently covered and to any who may be included under new legislation, EJC recommended a reduction from 75 to 70 as the age beyond which deductions would not be made from benefits on account of outside earnings; that benefits be increased for those who continue in covered employment beyond the retirement age; and that in computing the average annual wage a deduction of the four years of poorest earnings be permitted to cover periods of illness or abnormally low earnings.

Civil Service legislation is of great interest to many of our members. So many bills have been presented in the present session that it is difficult to follow them. A final bill will undoubtedly be drafted by the responsible committee chairmen. The politically popular proposals are for raises for postal employees and for "cost of living" raises, especially affecting the lower grades in the classified service.

The administration proposal, based on expert studies, calls for larger raises in the higher grades, varying from $190 a year raise in the GS-5 grade to an $800 raise in the GS-15 grade. In the so-called super-grades, and $800 raise would be provided except that the top-grade GS-18 would remain unchanged at $14,800.

On the other hand, the bill supported by the A.F. of L.'s American Federation of Technical Engineers would give the lowest grade a $400 boost and the top grade a $1,000 boost.

The other basic proposal of interest to engineers would provide for a study by the Civil Service Commission of the salaries of engineers and the desirability of raising the pay of engineers and allied groups independently of other classified employees. As an illustration of Society procedures in such matters, after this bill was introduced it was transmitted to Society headquarters for any consideration by the Committee on Salaries and to the corresponding committee of the District of Columbia Section which has a special interest in the subject. In addition, the Civil Service Commission asked its Advisory Committee on Engineers for comments on the bill. This committee of representative engineers made a report to the Civil Service Commission, which has supplied some information on engineers' salaries to the congressional committees.

Housing Legislation

The Housing Bill, H.R. 7839, including urban redevelopment and the advance planning of public works, has been approved by the House Committee. In the Senate some amendments of interest to engineers, relating to prevention of air pollution, were introduced. Engineers Joint Council has been actively interested in this subject. H.R. 8764 provides for rapid amortization for tax purposes of equipment required for air-pollution prevention. S. 2938 provides for a research program on smoke control and authorizes a maximum of $50 million in government loans to private companies for the purchase of smoke-control equipment. Such loans would be handled by the Housing and Home Finance Agency. It would seem that the always troublesome field of housing would require the full attention of this agency, without burdening it with such unrelated auxiliary activities as keeping the atmosphere clear and avoiding depressions through the planning of public works.

Highway Legislation

Highway engineers and officials are generally quite satisfied with the accomplishments of the present Congress in highway legislation.

A compromise highway bill, H.R. 8127, authorizing $966 million a year in federal aid for highway building in the fiscal years 1956 and 1957 has been passed by both Houses of Congress. That is about $400 million a year more than under present law. The House had originally authorized $875 million a year, while the Senate approved more than a billion.

The compromise bill would authorize $875 million a year in federal contributions for highway projects in which states and local governments share financing and direct the construction. Of the $875 million, $315 million will go to primary roads, $210 million to secondary roads, and $175 million to urban roads. The remaining $175 million was earmarked for the inter-state system, selected portions of the primary network singled out for special attention because of national defense importance. In the conference on this bill, a House provision that money for interstate highways should be linked to revenue from the federal gasoline tax was eliminated.

Miscellaneous Legislation

An interesting proposal for acquiring government buildings by lease-purchase is made in H.R. 6342. Under the proposal, the government would acquire title, at the expiration of a long-term lease, of buildings specially designed for its use. Critical space needs could thus be fulfilled without the huge capital outlays needed for government construction. During the lease, the property would remain on the local tax rolls, and investors would find attractive opportunities for safe investment in public construction. After passage by the House, the Senate added an amendment requiring approval by the House and Senate Committees on Public Works for all proposed projects. A similar bill failed of passage in a previous Congress.

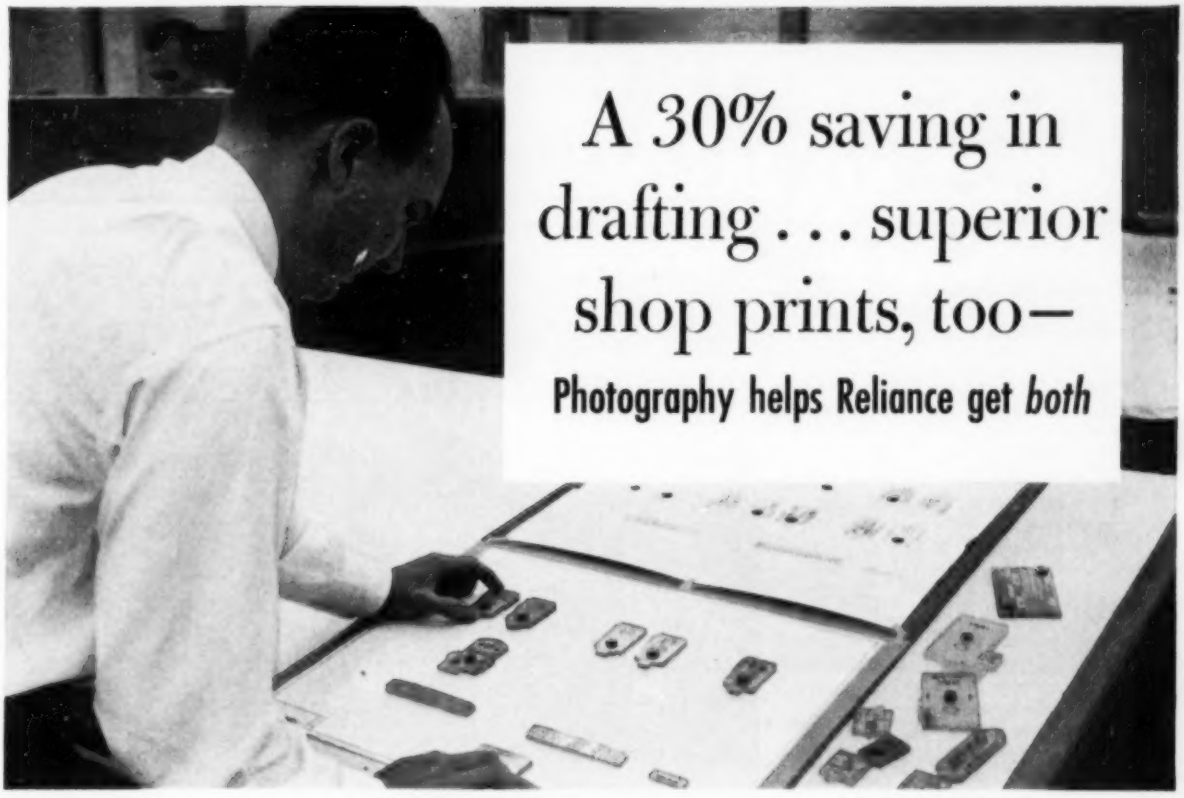
The bill to provide judicial review in disputes on government contracts, and the bill providing for the renewal of the contract renegotiation law, with some amendments which ASCE has supported, are making progress toward final enactment. The bill to provide for separate letting of speciality contracts, supported by some subcontracting groups and opposed by the Associated General Contractors has been tabled in committee.

Washington, D.C.

April 16, 1954

ASCE MEMBERSHIP AS OF APRIL 9, 1954

Members	8,555
Associate Members	10,997
Junior Members	17,585
Affiliates	71
Honorary Members	42
Total	37,250
(April 9, 1953	36,072)



A 30% saving in drafting . . . superior shop prints, too—

Photography helps Reliance get *both*

At the Reliance Electric & Engineering Co., Cleveland, Ohio, the use of photographic templates and Kodagraph Autopositive Paper has helped to lower drafting-room costs by at least 30%, besides assuring highly legible shop prints day in and day out.

The templates—on clear plastic—represent the designs of standard components that appear again and again in Reliance's many wiring diagrams. A draftsman uses them, first, to make a preliminary drawing – positioning the templates he needs on whiteprint paper, making a print, then roughing in the hook-up lines.

After this drawing has been approved, he prints the templates on Kodagraph Autopositive Paper, using a printing frame. Simple photographic processing—under normal roomlight—produces a positive print of the layout directly. All he has to do now is add the hook-up lines, and another drawing is ready for Reliance's file of photo-lasting Autopositive "originals." *Another saving can be chalked up!*

Reliance has found these photo-drawings to be ideal printing intermediates. They're evenly translucent, durable; have crisp, dense black lines. And they produce top-quality shop prints at practical, uniform speeds in Reliance's direct-process machine.

Learn how thousands of companies are simplifying drafting and drawing reproduction routines, and protecting valuable originals with Kodagraph Autopositive Paper. See how you, or your local blueprinter, can process this sensational material quickly, at low cost. Mail coupon today.

Kodagraph Autopositive Paper

"THE BIG NEW PLUS" in engineering drawing reproduction

MAIL COUPON FOR FREE BOOKLET

EASTMAN KODAK COMPANY, Industrial Photographic Division, Rochester 4, N. Y. 93

Gentlemen: Please send me a copy of "Modern Drawing and Document Reproduction," which gives all the facts on Kodagraph Autopositive Paper.

Name _____ Position _____

Company _____ Street _____

City _____ Zone _____ State _____

Kodak

Return Your Ballot on Dues
See Page 70

NOTES FROM THE LOCAL SECTIONS

(Copy for these columns must be received by the tenth of the month preceding date of publication.)

Technical Divisions Circulate Newsletters

Improved communication among members enrolled in the various Technical Divisions of the Society is being achieved through publication of a number of specialized newsletters. Divisions with such publications in print are the Hydraulics, Irrigation and Drainage, Soil Mechanics and Foundations, and Construction. Several others will shortly follow suit.

The newsletters are being circulated to every member enrolled in the Division sponsoring the publication to acquaint them with current plans and endeavors, and to describe opportunities for individual participation in the work of the Division. Members wishing to receive the newsletter for the Division of their choice need only to be enrolled in that Division. An enrollment form is given on page 133 of this issue.

Hydraulics Division Meeting Scheduled for Austin, Tex.

The Society's Hydraulics Division will hold a meeting at Austin, Tex., September 8–10, 1954, with the Austin Branch of the Texas Section acting as host. General chairmen for the meeting are Robert L. Lowry and John H. Montgomery, of Austin. Mr. Montgomery is currently president of the Texas Section. Meeting headquarters will be an air-conditioned hotel, to be announced later.

The meeting will follow the general pattern of the successful Hydraulics Division meetings held in recent years in Jackson, Miss., and Minneapolis, Minn. There will be a general opening session, followed by programs being planned by the Committees on Hydrology, Floods, and Ground Water. Inspection trip objectives include the University of Texas, the State Capitol, and projects on the Colorado River. Several non-technical events of interest are also being planned.

The complete technical program for the meeting is now being worked out by the Executive Committee of the Hydraulic Division, which is headed by G. H. Hickox, of Knoxville, Tenn. It will be published in the August issue of CIVIL ENGINEERING.

The **Arizona Section's** new program of quarterly meetings got off to a good start with a well attended, all-day meeting in Phoenix on March 13. Featured events included visits to the Litchfield Naval Air Facility near Phoenix and the Phoenix Squaw Peak Water Treatment Plant, which is just being completed, and a luncheon at

Five presidents exchange greetings at the Alabama Section's spring meeting, a joint session with the Alabama Polytechnic Institute Student Chapter, held at Auburn, Ala., on March 5. They are (left to right) C. M. Landstreet, president, API Student Chapter; Dr. R. B. Draughon, president, API; W. F. Palmer, president, Alabama Section; ASCE President Daniel V. Terrell; and L. C. Wilson, president, University of Alabama Student Chapter. The attendance of 75 included 35 students. President Terrell was principal speaker at the banquet concluding the all-day program.

President Terrell (third from right) is guest of honor at a joint meeting in Gainesville, Fla., at which the Gainesville Subsection of the Florida Section and the University of Florida Student Chapter were hosts to the Section. In the speech of the evening, President Terrell explained the work and organization of the Society. Shown with him are A. O. Patterson, president, Florida Section; H. F. McDonell, president, Gainesville Subsection; W. J. Stone, Jr., president, University of Florida Student Chapter; President Terrell; Joseph Weil, dean of engineering, University of Florida; and L. E. Grinter, dean of the graduate school and director of research, University of Florida.

THIS GUARDRAIL

KEEPS TURNPIKE TRAFFIC AND COSTS IN LINE

FLEX-BEAM Guardrail provides high visibility protection on the Maine Turnpike. The West Virginia and Ohio Turnpikes, now under construction, will also use Armco FLEX-BEAM Guardrail.

Hundreds of miles of Armco FLEX-BEAM Guardrail are protecting motorists along danger spots on many of our finest turnpikes and expressways.

Economy, strength and ease of maintenance are three big reasons for the wide acceptance of Armco FLEX-BEAM. A small crew installs the rail quickly with ordinary hand tools. Seven bolts join each 12½-foot section—the center bolt holding the rail to the post.

This deeply corrugated rail is not easily damaged. High beam strength extends through the overlapped joints, distributing any impact among the adjacent posts. An occasional coat of paint, to retain the high visibility of FLEX-BEAM, is about the only maintenance needed. There are no springs to adjust and nothing to get out of order. Write us for complete data. Armco Drainage & Metal Products, Inc., 3314 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation. In Canada: write Guelph, Ontario. Export: The Armco International Corporation.

ARMCO FLEX-BEAM GUARDRAIL

ARMCO

Armco FLEX-BEAM is a familiar sight on the New Jersey Turnpike and its approaches. Notice the perfect alignment on this curved section.

On Oklahoma's Turner Turnpike, FLEX-BEAM assures continuing safety at low cost. Painting is the only maintenance needed.

the Armed Forces Officers Club in Phoenix.

How far the Society can go in backing members who resist joining a trade union was discussed at the **Akron Section's** March dinner, following a report by Section President Howard Miller of a recent joint engineering meeting in Columbus to study the whole problem of unionization. The technical program consisted of a talk by Charles E. Cockerham, manager of the Akron-Canton Airport, on the subject, "An Adequate Airport for Your Community."

There was a turnout of about 100 for a special dinner meeting of the **Buffalo Section** arranged to honor ASCE President Daniel V. Terrell. In the featured speech of the evening, Dean Terrell discussed many phases of Society functioning and engineering problems in general. Other guests of the Section and speakers were A. A. K. Booth, ASCE Director for District 3, and Paul W. Mohn, dean of the University of Buffalo School of Engineering.

Members of the **Central Illinois Section** attending the February dinner, held at Urbana on the 16th, heard Prof. H. J. Scharader, of the University of Illinois, discuss the development of railway car wheels and the many problems encountered in design and upkeep of the wheels. The major problem confronting the railroads, Professor Schrader said, is the high state of thermal stress (from 800 to 1000 deg F) developed in braking.

In a talk on "Blast-Resistant Design" featured at the March meeting of the **Cincinnati Section,** Nathan M. Newmark, research professor of structural engineering at the University of Illinois, said that the deflection approach to such design is unsatisfactory, partly because of the "sensitivity of deflections to explosive loads." For economy, Professor Newmark recommended the type of superstructure in which failure of the structural frame is prevented, but no attempt is made to design the siding to resist failure rather than the completely enclosed structure in which the siding as well as the framing must be designed to resist explosive forces.

Riveted and bolted connections, with emphasis on high tensile bolting, were discussed at the **Cleveland Section's** March meeting by W. C. Stewart, technical adviser to the Industrial Fasteners Institute. ASCE Vice-President G. Brooks Earnest reported the Atlanta meeting of the Board of Direction.

Speakers at recent meetings of the **Duluth Section** have been Marshall Ford, district manager for the Lincoln Electric Co., and Harold B. Ewoldt, vice-president of the White Pine Copper Co. Speaking on "Getting the Most from Your Welding Dollar," Mr. Ford introduced a new type of electrode called "Jetweld," in which powdered metal is used with the electrode for speedy economical welding application.

Practically any kind of soil can be dewatered by methods now available, members of the **Georgia Section** were told at their April 2 luncheon meeting. The speaker was Byron J. Prugh, assistant chief engineer for the Moretrench Corp., of Rockaway, N.J., and his subject "Wellpoint—a Tool of Contemporary Construction."

The responsibilities and functions of engineers in large industrial organizations and some of the methods that industry uses to make best use of them were the topic of discussion at the **Intermountain Section's** March meeting, with L. G. Haskell, chief engineer for the Salt Lake Pipeline Co., the principal speaker. In the enthusiastic general discussion that followed his talk emphasis was given to the need for both industrial organizations and government agencies to utilize the services of student engineers during the summer months.

Presentation of awards of Junior membership in the Society to two graduating engineers in Iowa colleges was a highlight of the **Iowa Section's** March meeting, held at Des Moines on the 24th. The winners were Clifford V. Smith, Jr., of the University of Iowa, and Ralph W. Speer, of Iowa State College. ASCE President Daniel V. Terrell spoke on Society affairs and presided at a question-and-answer period that followed.

The **Ithaca Section's** March dinner meeting honored President Terrell and the Section's new life members. On hand to receive their certificates of life membership were S. C. Hollister, dean of the College of

Wives' Auxiliary of Hawaii Section, formed in 1953, met during the Section's March 1 meeting to install their first regular officers. Shown, left to right, are Mesdames Franklin Sunn, treasurer; W. M. Wachter, secretary; E. B. Nutter, president; and Francis Wai, vice-president.

Hawaii Section banquet, culminating feature of the Section's all-day conference on March 1, is addressed by ASCE Director I. Cleveland Steele (standing, in left-hand photo). Others at the head table are Hawaii Section President Arthur Akinaka, Mrs. Steele, L. C. Urquhart, Mrs. William Wachter, and W. W. Brewer. The view at right shows Mr. Akinaka; Mason G. Lockwood, ASCE Vice-President, Zone IV; William W. Brewer; Mr. Steele; Leonard C. Urquhart; and Donald Austin, treasurer and conference chairman. More than a hundred engineers attended the conference, which featured talks by Mr. Brewer, San Francisco resident partner of Dames & Moore, who read a paper on "The Influence of Soils on Foundations"; Mr. Lockwood, who analyzed the ASCE Code of Ethics (abstract of his talk on page 70); and Director I. C. Steele and Col. L. C. Urquhart.

WASHINGTON, D. C.

PREFERS

Concrete Pressure Pipe

The District of Columbia, home of the Nation's capitol, recognizes the advantages of concrete pressure pipe. From 1925 to the present, over 175,000 feet of concrete pressure pipe have been installed in this congested 69 square mile area. Pipe diameters range from 20″ to 78″, with heads from 70 up to 450 feet. A substantial part of this footage is in use in the Washington, D. C. distribution system.

Washington engineers consider economy and length of service of primary importance when specifying water pipe . . . also, high carrying capacity, and ease of installation. Because concrete pressure pipe meets these and other exacting requirements, it has been selected time and again for new supply mains and extensions to the distribution lines.

If your community is planning additional water lines, or replacements for old lines, check into the advantages of concrete pressure pipe. It is available in sizes from 12″ to over 12′ in diameter, for high or low heads, and can be installed to fit your individual requirements.

Member companies are equipped to manufacture and furnish concrete pressure pipe in accordance with established national specifications and standards.

Concrete PRESSURE Pipe

WATER FOR GENERATIONS TO COME

AMERICAN CONCRETE PRESSURE PIPE ASSOCIATION
225 North LaSalle Street
Chicago 1, Illinois

Wisconsin Section officers are shown here with Society officials attending the Section's March meeting. Seated (in usual order) are Lloyd D. Knapp, ASCE Director, District 7; G. Brooks Earnest, ASCE Vice-President, Zone III; and Raleigh W. Gamble, former Director. Section officers (standing, in the same order) are Ralph E. Boeck, president; Ralph P. Larsen, first vice-president; Arno T. Lenz, second vice-president; and Richard C. Dess, secretary-treasurer. There was a turnout of 100 to hear Professor Earnest report the results of the Atlanta Convention and discuss Society issues.

Engineering at Cornell University, and John E. Perry and Paul H. Underwood, emeritus professors of civil engineering at Cornell. President Terrell brought the group up to date on recent Board actions.

Kansas' Seven Engineering Wonders, as seen by members of the **Kansas Section,** are: (1) the Intercity Viaduct at Kansas City; (2) the Topeka Avenue Viaduct at Topeka; (3) the Rock Island Railroad crossing of the Cimarron River near Arkalon, Kans.; (4) the A.T. & S.F. hump yard at Turner, Kans.; (5) relocation of U.S. Highway 40 from Junction City to K99; (6) the Turkey Creek diversion tunnel at Kansas City; and (7) the airplane industry of the state. Announcement of these choices was made at the Section's March meeting, at which E. R. Leeson, district engineer for the Water Resources Division of the U.S. Geological Survey, showed a film on "Topographic Mapping by Photogrammetric Methods."

Carl L. Kreidler, chief structural engineer for the Lehigh Structural Steel Co., Allentown, Pa., was featured speaker at the March meeting of the **Lehigh Valley Section** —a joint dinner meeting with the American Welding Society in Allentown. Discussing the topic, "Welding of Structural Steel," Mr. Kreidler compared the weight-saving advantages of welding over riveting with the slightly greater economy afforded by riveting. Other advantages attributed to welding are lower painting and maintenance costs and the relative absence of noise in erection. Mr. Kreidler illustrated his talk with a film showing the erection of welded extensions to the Fairchild Aircraft plant at Hagerstown, Md., and slides of other projects for which his firm has fabricated steel.

Student speakers were featured on the program for the **Maryland Section's** March meeting. The students—Hans Schweizer, of the University of Maryland, and Ronald L. Mann, of Johns Hopkins University—have been selected as outstanding senior engineering students at their universities and will receive the Section's annual awards of Junior membership in the Society. Mr. Schweizer described his personal experiences on construction of bases in Labrador and Greenland, and Mr. Mann's topic was "Special Conditions for Retaining Walls." Walter Boyer, Faculty Adviser for the Johns Hopkins Chapter, complimented the Section for its notable success in interesting students in the Society.

Competitive bidding for engineering services as the subject of the March 24 meeting of the **Metropolitan Section's Junior Branch** drew a packed house. Both speakers—Eugene Harlow, vice-president of Frederic R. Harris, Inc., and Robert K. Lockwood, associate editor of CIVIL ENGINEERING—sought to bring out the inherent weaknesses of choosing professionals on a low-bid basis. "It is the public which suffers when professional services are pared to meet the exigencies of competitive bidding," they emphasized.

A progress report on "Research in Space Frame Construction" was presented at the **Michigan Section's** annual joint meeting with the University of Michigan Student Chapter on April 1, by Professors C. T. Larson and Paul H. Coy, of the university's School of Architecture and Design, and Prof. Leo M. Legatski, of the College of Engineering. When finished, the research will show a method of building construction geared to mass production of fabrication and erection. Certificates of life membership were presented to Don W. Bingham, Harry L. Conrad, H. S. De Groodt, Alfred T. Hopkins, Martin J. Orbeck, Walter M. Pratt, Walter C. Sadler, and F. C. Whitney.

In the hope of steering students into professions for which they are best suited, the **Vicksburg Branch** of the **Mid-South Section** took full responsibility for the engineering part of a recent month-long vocational guidance program sponsored by the Vicksburg Kiwanis Club. Frank Redus is chairman of the Branch's Vocational Guidance Committee.

President Terrell and ASCE Director A. A. K. Booth were guests of honor and speakers at the March meeting of the **Mohawk-Hudson Section,** held at Latham, N.Y., with about 80 present. The President's speech and the discussion that followed centered about the need for a New York State Council and the function of such a council in handling legislative and other matters affecting engineers in the state. Student Chapter officers from Union College and Rensselaer Polytechnic Institute were guests of the Section.

The challenge to leadership offered civil engineers was discussed in the featured talk at the **Nebraska Section's** March meeting by Col. Thomas J. Hayes, III, district engineer for the Corps of Engineers at Omaha.

Ben Torpen, chief of the Northern Pacific Division of the Corps of Engineers, spoke on flood control work in Pakistan and showed slides of his travels there at the March meeting of the **Oregon Section.** Activities of the Board of Direction at Atlanta were reported by ASCE Director Glenn Holcomb.

There was a turnout of nearly 200 for the March meeting of the **Philadelphia Section,** which was sponsored by the **Junior Branch.** Mario Matrisciana, division sales engineer for Timber Structures, Inc., pinchhitting for Elon E. Ellis, vice-president of the company, showed a color film of the entire process of fabricating structural timber members, from felling in the forest to assembly. Creosoting and fireproofing processes were also described. Various phases of surface water supply were discussed by a panel of authorities at a recent meeting of the Central Pennsylvania Subsection held in

Scheduled ASCE Conventions

ATLANTIC CITY CONVENTION
Atlantic City, N.J.
Chalfonte-Haddon Hall
June 14-19, 1954

NEW YORK CONVENTION
New York, N.Y.
Hotel Statler
October 18-22
1954

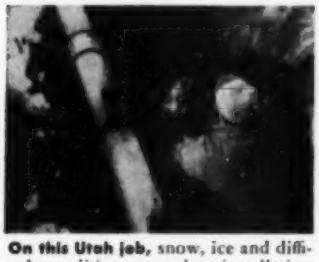
SAN DIEGO CONVENTION
San Diego, Calif.
Hotel U. S. Grant
February 6-11, 1955

Question:

Can we get installation savings and performance too?

Answer:

Yes...with the new Ring-Tite Coupling



On this Utah job, snow, ice and difficult conditions caused no installation slowdown.

In this California installation, flexible Ring-Tite joints permitted easy conformance to curves.

Speeds assembly of Transite Pressure Pipe

In state after state, contractors are learning that Transite® Pressure Pipe and the new Ring-Tite® Coupling provide fast, sure pipe line assembly with tight, dependable joints . . . strength to assure lasting, trouble-free water mains through the years.

With Ring-Tite, installation costs less—assembly follows digger closely. Typical contractors' comments: "On entire job, trencher and backfiller seldom over 150 feet apart . . ." "Laid 6" Class 150 Ring-Tite at a rate of 5000 feet per 8 hours."

The design of the Ring-Tite Coupling permits quick, easy alignment. To assemble, rubber rings are simply popped into grooves. Then lubricated pipe ends slide in under rings smoothly, easily and surely.

Pipe ends stop positively—with ends automatically separated within coupling. This separation gives the line flexibility to withstand shock and vibration, relieves line stresses, permits conformance to curves. Installations can be completed under adverse weather, temperature or terrain conditions. No complicated equipment is required.

Transite Pressure Pipe and the Ring-Tite Coupling are made of asbestos and cement. Strong and durable, they cannot rust; are highly resistant to corrosion. Tested to A.W.W.A. specifications.

For the new Ring-Tite folder TR-142A—please write to Johns-Manville, Box 60, New York 16, N. Y.

(See us at Seattle—Booths 70-72 A.W.W.A. Convention)

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville TRANSITE PRESSURE PIPE

NOW WITH THE RING-TITE COUPLING

Harrisburg. The experts were J. W. Mangan, federal hydrologist for the Pennsylvania Department of Forests and Waters; Carlyle Gray, acting state geologist; C. C. Wilbur, sanitary engineer for Gannett Fleming Corddry & Carpenter; L. D. Matter, assistant chief engineer for the Pennsylvania Department of Health; and Dr. Linwood Grace, director of the Bureau of Dental Health, Pennsylvania Department of Health.

Speakers at the March meeting of the **Pittsburgh Section**—a joint session with the Engineering Society of Western Pennsylvania—were F. H. Dill, welding engineer for the American Bridge Division of the U.S. Steel Corp., with a paper on "Steel in Welded Structures" and G. O. Hoglund, chief of the Alcoa Process Development Laboratory, Aluminum Company of America, who spoke on "Welding of Aluminum Structures." Frank C. Sturges, vice-president and general manager of the Pennsylvania Drilling Co., Pittsburgh, described "Pittsburgh Underground" at the April meeting (also a joint session with the ESWP).

The **Sacramento Section** has formed a **Nevada Subsection,** with headquarters at Reno. Officers, elected at the organization meeting on March 16, are Howard B. Blodgett, president; Fred W. Clayton, vice-president; and Vernon M. Meiser, secretary-treasurer. Meetings will be held on the third Tuesday evening of each month. Addressing other Subsection meetings in March were Felix Wallace, dean of the Engineering School, College of the Pacific, who spoke before the **Central Valley Subsection** on prestressed and post-stressed concrete; Theodore Neuman, of the State Division of Water Resources, who discussed engineering aspects of the proposed Feather River Project before the **Marysville Subsection;** and Irvin M. Ingerson, supervising hydraulic engineer for the California Water Project Authority, who gave a talk on "The Engineer and the Attorney in Trial" before the **Shasta Subsection.**

Guest speaker at the **San Diego Section** February meeting was Kenneth Godwin, captain, CEC, U.S. Navy, who described construction in the Mediterranean area and his duties on the NATO staff there. Charles H. Young, local consultant, spoke at the March meeting on the importance of a competitive rail and highway distribution system to the flow of trade through San Diego Harbor, and the factors involved in capturing supremacy. ASCE Director M. J. Shelton gave a brief rundown on the reasons for the proposed dues increase.

Featured speakers at recent meetings of the **Tacoma Section** have been Sid Lida, of the Applied Science Department, International Business Machines Corp., who discussed automatic computing machinery at the February meeting, and Herman A. Poulin, of Helicopter Service, Inc., who described engineering uses of the helicopter at the March meeting. Interesting films were shown at both meetings.

The organization of the Fort Worth Department of Public Works was explained to members of the **Texas Section's Fort Worth Branch** attending the March 8 luncheon meeting. The speaker, C. Milo Thelin, director of public works, also outlined the city's proposed works program for the coming year. Wives of members of the **San Antonio Branch** were guests at the March dinner meeting of the Branch, which was addressed by W. R. Woolrich, dean of engineering at the University of Texas. Dean Woolrich's subject was "Unionization and Engineers."

Details of the recent Columbus meeting of Sections in Ohio to discuss the unionization issue were reported at the **Toledo Section's** dinner meeting on March 10 by C. H. Kurtz, Jr., and R. J. Nopper. The technical program consisted of an illustrated talk on "Aluminum as a Structural Member" by R. C. Kasser, head of the Structural Sales Division, Aluminum Company of America.

This suspension bridge, built by the Washington University (St. Louis) Student Chapter for display during the university's annual Engineers' Day celebration in March, has an overall length of 90 ft. Chapter members pose on the structure.

Coming Events

Arizona—Annual spring meeting at the Student Union Building, University of Arizona, Tucson, May 8.

Central Illinois—Annual joint meeting with University of Illinois Student Chapter at Latzer Hall, University of Illinois Y.M.C.A., Champaign, Ill., May 11.

District of Columbia—Meeting at the Cosmos Club, Washington, May 11, 8 p.m., featuring a symposium on "What Is Research Doing for Engineering?" with talks by authorities in the fields of metal, concrete and wood structures.

Los Angeles—Dinner meeting May 12, 7 p.m. (for reservations call Secretary Martin Duke at Bradshaw 2-6161 by May 10) followed by a talk at the Rodger Young Auditorium. Meeting of the Junior Forum at the Rodger Young Auditorium May 12, 6 p.m., and noon luncheon meetings every Friday at downtown restaurants, with the last luncheon of each month at the Engineers Club. The Sanitary Group will meet at the Taix French Restaurant May 26, 6:30 p.m. The Soil Mechanics Group will meet for dinner at the Clark Hotel, May 19, 6:30 p.m.

Maine—Meeting of the New Hampshire Branch in Manchester on June 12 will consist of a tour of construction of the toll highway between the Massachusetts border and Concord, N.H.

Metropolitan—Meeting in the auditorium of the Engineering Societies Building, May 19, 7 p.m. Meeting of Junior Branch in the ASCE Board Room, May 12, 7:30 p.m.

Mid-South—Dinner meeting of the Central Savannah River Valley Subsection in Augusta, May 12.

Mohawk-Hudson—Dinner meeting at the Stuyvesant Hotel, Kingston, N.Y., May 20.

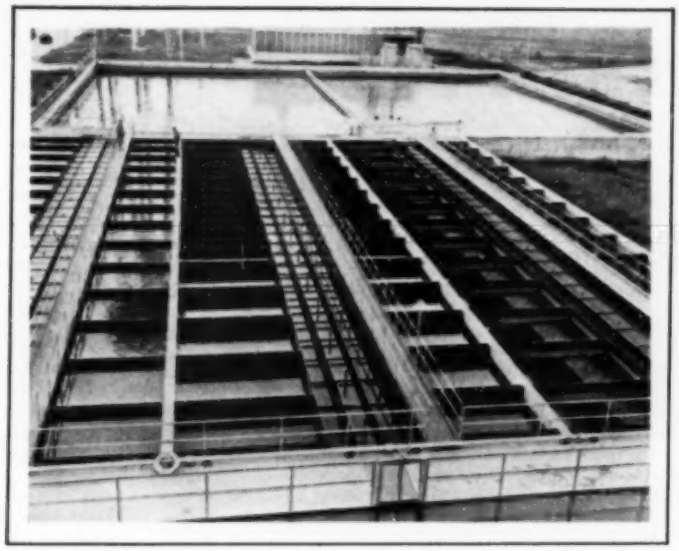
Pittsburgh—Meeting of the Junior Branch in the Pittsburgh Room of the Hotel William Penn, May 20.

Sacramento—Weekly luncheon meetings at the Elks Temple every Tuesday at 12 noon.

Syracuse Section—Meeting in the Women's Bldg. at Syracuse University, May 12, 8:00 p.m.

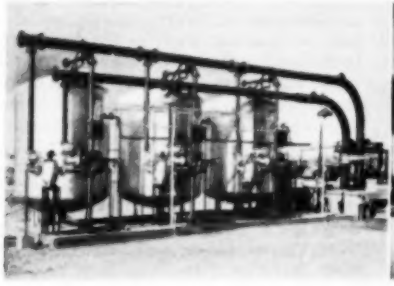
Tennessee Valley—Annual spring meeting at Muscle Shoals, Ala., May 14 and 15, featuring business and technical sessions followed by dinner at the Tuscumbia Country Club on Friday and tour of a local plant on Saturday. Headquarters for the Secretary will be the Muscle Shoals Hotel in Sheffield, Ala.

West Virginia—Two-day meeting at Charleston, W.Va., June 4 and 5, featuring a dinner session on Friday evening, and inspection of the West Virginia Turnpike on Saturday.



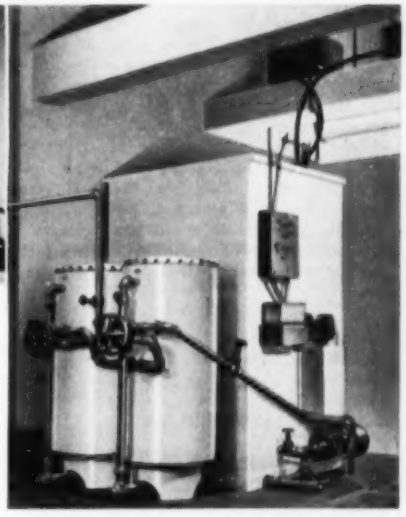
PRECIPITATOR. Coagulation, precipitation and settling in one operation! Minimum space . . . stable effluent. Reduces turbidity, color, taste, odor, hardness, iron, manganese, alkalinity, silica.

WHICH Permutit Process will solve YOUR water problem?



ZEOLITE (Ion Exchange) SOFTENERS remove total hardness. Reduce iron and manganese. Permutit multiport-valve control is fully automatic! Saves operator's time . . . increases efficiency.

FILTERS. Rapid type gravity filters in concrete or steel. Vertical or horizontal pressure filters. Manual or fully automatic multiport-type control for single units or batteries.



PACKAGE WATER CONDITIONING PLANT. Reduces organic matter, turbidity, taste, odor, hardness, iron, manganese, alkalinity. Compact . . . ideal for small municipalities. Flow rates up to 50 gpm.

Permutit can help you decide . . .

PERMUTIT will make a free analysis of your city's water supply and make recommendations to you or your consultants. Remember — only Permutit manufactures both ion exchangers and all types of water conditioning equipment.

Write today for information on municipal water conditioning equipment. The Permutit Company, Dept. CV-5, 330 West 42nd Street, New York 36, N. Y.

Water Conditioning Headquarters for Over 40 Years

PERMUTIT®

NEWS BRIEFS . . .

Commercial Building Boom Forecast for 1954

Commercial construction this year is due for a rise of at least 10 percent above last year's peak of $2.2 billion, the Chamber of Commerce of the United States predicts. All kinds of commercial construction will share in this trend, according to the Chamber. Capital outlay for office buildings and warehouses, as a group, can be expected to total 15 percent more than in 1953, while expenditures for stores, restaurants, and garages are forecast to be at least 5 percent more.

If to these main classes of commercial construction are added hotels, motels, and recreation buildings, the 1954 total will reach $2.4 billion, compared with the 1953 total of around $2.2 billion, the Chamber of Commerce notes.

Two spectacular features are seen as characterizing the current boom—office building expansion and a great wave of shopping center construction. After four years of high-volume building, New York City still has less than 1 percent vacancy in first-class space and nearly 6,000,000 sq ft of additional office space is under construction or in prospect. Pittsburgh, another pioneer in the new office building era, still has plans ahead. Boston, Philadelphia, and Chicago are all busy with new structures, while construction of new office space is under way or planned in Baltimore, Washington, Atlanta, Dallas, Houston, Denver, Los Angeles, and San Francisco.

Major shopping centers projected for 1954 include the great Skokie Center, northwest of Chicago, and the Northland Center adjoining Detroit, which is now nearing completion. The Chamber notes that the construction of shopping centers generally has been stimulated by the dispersion of new housing since the war together with the vast increase in automobiles in recent years.

Another type of development featured in the commercial building boom is the integrated central area project, of which Rockefeller Center in New York is the prototype. The Gateway Center project in Pittsburgh, now partially complete, exemplifies the current trend—office buildings set amid broad landscaped areas, shopping facilities, pedestrian walks safe from traffic, ample parking space, and possibly a hotel, all in an integrated whole. The Penn Center development in Philadelphia, utilizing space formerly occupied by the old Broad Street Station and the tracks leading to it, will be along the same general lines. Work on the first building is expected to begin this year. In Boston, the old 28-acre Back Bay railway yard, which split the city in two, is slated for similar treatment. Preliminary work on the latter project will probably be started this year.

Powerful Proton Accelerator Is Placed in Operation

The world's most powerful particle accelerator, the University of California Bevatron, has gone into successful operation, according to an announcement from the U.S. Atomic Energy Commission. In design and construction for the past six years in the university's Radiation Laboratory, the machine has accelerated protons, the nuclei of hydrogen atoms, to an energy of 5 billion electron volts, the highest energy ever achieved by an accelerator. The $9,000,000 machine was built with AEC funds.

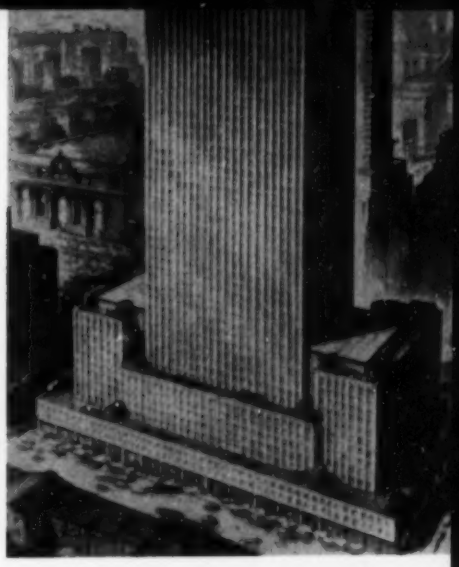
According to Dr. Ernest O. Lawrence, director of the laboratory and a pioneer in the development of the cyclotron, "The Bevatron gives us the means to make laboratory explorations of the nucleus that have not been possible before. We do not know what we shall find, for if we did there would be no need to build the machine. We do know that every time we have extended the energy range of nuclear research, we have increased our understanding of the fundamental nature of the nucleus."

In developing the Bevatron, Dr. Lawrence noted, the Radiation Laboratory has worked closely with the Brookhaven National Laboratory. The successful operation of their Cosmotron, he said, accelerated the early operation of the Bevatron.

Huge Haunch Girders Placed in Raritan River Bridge

First of four giant haunch girders—more than 263 ft long and weighing 200 tons apiece—is being lifted 135 ft in the air and set in place in the Raritan River Bridge, largest of the 282 crossings along the right of way of the Garden State Parkway. Fabricated at the Pottstown, Pa., works of the Bethlehem Steel Co., the girders were transported in sections on railroad flat cars to Jersey City, where they were assembled on a car float, which was towed to the bridge site by tugs. In erection, one end of the girder was hoisted by a derrick-traveller with 115-ft boom on the bridge deck, the other by a derrick with 85-ft boom standing upon the 120-ft tower of a tower-derrick boat. It was the first time in the experience of Bethlehem Steel Co. construction engineers that girders of such size were picked off a car float and erected in this manner. The Raritan River Bridge will be completed in July.

Mammoth Socony-Vacuum Building to Be Erected in New York



New York's largest building project in the past quarter of a century is now under way, following recent start of excavation for the foundations of the 42-story Socony-Vacuum Building, shown here in artist's rendering. The largest structure to go up in New York since the Empire State Building, the project will occupy the entire two-acre block bounded by Lexington and Third Avenues and 41st and 42nd Streets. It will provide 1,300,000 sq ft of rentable space and working accommodations for 10,000 persons. More than 90 percent of this space is already rented, with the Socony-Vacuum Oil Co. a major tenant. Steel erection will start in the fall, and completion of the building within two years is planned. Edwards & Hjorth, of New York, are structural engineers on the project; Jaros, Baum & Bolles, the mechanical engineers; and Harrison & Abramovitz and John B. Peterkin, the associated architects. The general contractor is the Turner Construction Co., of New York. Structural steel will be furnished and erected by the American Bridge Co., division of U.S. Steel Corp.

Construction Expenditures in First Quarter Total Record $7.3 Billion

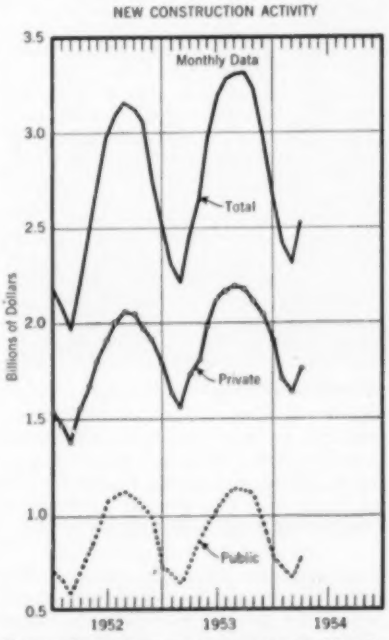
Expenditures for new construction rose seasonally in March to $2.5 billion, bringing the 1954 first-quarter total to a record $7.3 billion, or slightly more than the first-quarter total last year, according to preliminary estimates of the U.S. Department of Labor's Bureau of Labor Statistics and the Building Materials and Construction Division of the U.S. Department of Commerce. After adjustment for seasonal factors, new construction activity during the January-March 1954 period was at an annual rate of $36.1 billion—well above the $34 billion forecast for the year.

Most of the overall increase in March reflected expansion during the month in private housing and public-utility construction, plus gains in highway work. Total private spending rose 8 percent to almost $1.8 billion, with almost all types of work showing a strong seasonal uptrend. New work on residential building rose by 11 percent from February to $854 million, about the same outlay as a year ago, and private spending for public-utility construction increased by an eighth over the month to $338 million. Private industrial building, which usually declines in the earlier months of the year, decreased less than seasonally in March, while commercial building failed to show the usual seasonal rise from February.

Although all major types of public construction showed an increase over the month, the rise in total public outlays (14 percent to $773 million) was somewhat less than usual for March.

Comparing the record volume for the current first quarter with that for the first quarter of 1953, private expenditures ($5.1 billion) were higher, and public outlays ($2.2 billion) were lower—each by 4 percent. Private residential building, accounting for half the total private expenditures, was the same as in the first quarter of 1953, while most other types of private building were up substantially. Commercial building was 44 percent higher. In major types of private work, expenditures were lower this year only for industrial construction, down by an eighth from the near-peak levels of early 1953, and farm construction, down by more than a tenth.

The lower level of public construction activity this year was influenced mainly by decreased federal spending for military facilities. In addition, public housing, hospital building, and federal conservation and development work were all down considerably from the first quarter of 1953, and public outlays for industrial plant were lower by 8 percent. The only major types of publicly financed construction showing gains from the 1953 first quarter were schools, highways, and sewer and water construction. Altogether, federal spending for new construction during the first quarter of 1954 was down by 17 percent from the same 1953 months, more than offsetting an 8 percent rise in state and local outlays.



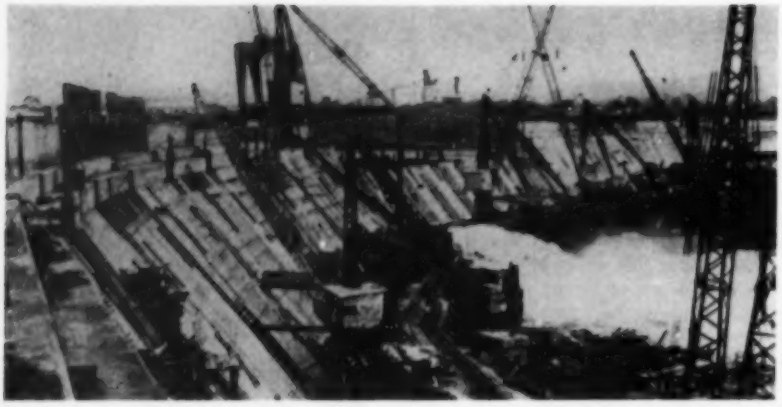
Seasonal rise in new construction in March to $2.5 billion, as shown in Department of Commerce curves, brings first-quarter total to record $7.3 billion.

New Etiwanda Steam Station Is Dedicated

Unusual economies in steam plant costs were effected in construction of the $35,000,000 Etiwanda station of the Southern California Edison Co., which was dedicated on April 14. Located at Fontana, Calif., about 50 miles east of Los Angeles, the new plant is of the outdoor type. Boilers, turbines, generators, and heaters stand on a steel and concrete platform open to the sky. Other equipment is protected merely by an overhead concrete deck. Only the administration building, central control room, and a few other areas are enclosed or shielded from the weather.

One of the largest stations in the United States to use cooling towers for circulating water, the Etiwanda station has a capacity of 250,000 kw. It is operated by fuel oil imported by pipe line from coast refineries and supplemented by natural gas and coke-oven gas obtained from the steel mill at Fontana. The Etiwanda plant is one of four major steam power stations in the area designed and built by the Stone & Webster Engineering Corp. in cooperation with the Engineering Department of the Southern California Edison Co. Total power capacity of the four plants is 997,500 kw.

Wallace L. Chadwick, M. ASCE, is vice-president in charge of engineering and construction for the Southern California Edison Co.



Owen Falls Dam, key installation in a project to provide a head of water for generating power for industrial development of Uganda and other East African territories and for giving far-off Egypt more irrigation water, will be put into operation this spring. First power unit will provide 15,000 kw, and ultimate capacity will be 150,000 kw.

Big African Dam to Go Into Operation

One of the greatest power projects in Africa will be inaugurated late this spring by Queen Elizabeth, when during her Commonwealth tour she presses a button that will open the sluices of the Owen Falls Dam in Uganda. The first power unit to go into operation will have a capacity of 15,000 kw. Eventually a total of ten turbines, with a combined capacity of 150,000 kw, will be installed. In addition to producing power for East Africa's growing industries, the project will increase the storage capacity of Lake Victoria and regulate its discharge in order to provide more irrigation water for far-off Egypt.

Spanning the White Nile at Jinja, just below Ripon Falls, the source of the 3,850-mile river, the dam makes Lake Victoria the biggest reservoir in the world. The concrete gravity-type structure is 2,500 ft long and 100 ft in maximum height. Through an agreement with the Egyptian government, the dam was raised one meter above the height necessary for power purposes alone to ensure Egypt storage of all the water it is likely to need. In addition to the main dam, there are two short dams forming the side of the headrace channel to the power house, and an intake dam upstream.

Construction of a power station at Owen Falls was recommended in 1947 by a British engineer, C. R. Westlake, who made a report on the power situation at the request of the Uganda government. After the report was accepted, a detailed project report was prepared by the consulting firms of Kennedy & Donkin and Sir Alexander Gibb and Partners. Contracts were let in 1948 and 1949, with the principal civil engineering work carried out by the Owen Falls Construction Co., an international group made up of British, Danish, and Dutch firms.

Most of the plant and equipment, amounting to 68,000 tons, was imported from the United Kingdom. All of it had to be carried 800 miles by rail from Mombasa. To help meet cement needs, a cement plant was built some 80 miles from the site. Since March 1953 when the plant began operation, it has provided 16,000 tons of cement for the project; the remaining 36,000 tons required were imported from Europe.

The total cost of the project up to 1956 is estimated at the equivalent of $61,600,000, which will include the cost of transmission line network amounting to $45,000,000. The Uganda Electricity Board is responsible for the cost of the project, with the Egyptian government bearing the cost of raising the height of the dam the extra meter required for power storage.

Government Creates Division of Sanitary Engineering Services

Major engineering programs of the Public Health Service have been consolidated into a Division of Sanitary Engineering Services under the direction of Chief Engineer Mark D. Hollis, M. ASCE, according to an announcement of the U.S. Department of Health, Education, and Welfare. Wesley E. Gilbertson, A.M. ASCE, has been appointed assistant chief of the Division. This is the first grouping of the engineering activities of the Department of Health, Education and Welfare under the direct supervision of an engineering officer.

A comprehensive attack on the sanitary engineering problems brought about by our fast-moving technology is on the program of the new Division. The program also includes the maintenance of professional engineering relationships with technical and professional societies and universities. New laboratory facilities have been completed for the Sanitary Engineering Center at Cincinnati, Ohio. The Center was dedicated in April (see opposite page).

New "Who's Who in Engineering" Is Out

The new (seventh) edition of *Who's Who in Engineering*, which is just out, will be an invaluable reference work. Though the new edition contains over 20 percent more biographical data than the previous edition, it is a lighter, more compact volume. This increased coverage with less bulk has been made possible by the use of "Bible" paper. In the preface to the 2,861-page volume, the editors—Winfield Scott Downs and Edward N. Dodge—note that the present edition is by far the most comprehensive of the series of seven that goes back to 1922. They also express warm appreciation for the aid given in publishing the volume by an Engineers Joint Council Advisory Committee, headed by Andrey A. Potter.

In accordance with previous custom, the publishers will supply reprints of records to individuals wishing them at a cost of $6.00 per hundred. Considerably lower rates are available for quantity orders. The volume itself sells for $17.50. Inquiries should be sent to the Lewis Historical Publishing Co., 265 West 14th Street, New York 11, N.Y.

Fort Randall Dam Produces First Power

First hydroelectric power produced by a main-stem dam built under the Pick-Sloan plan recently went on the line when water from Fort Randall Dam was released—by President Eisenhower by telegraphic impulse—to activate a generator that will supply 20,000 kw of electric power for South Dakota and Nebraska. The generator is one of eight that will be turned on at four-month intervals until the dam's full electrical capacity of 320,000 kw is reached. Power from the project will be supplied to cooperatives of the Rural Electrification Administration, to municipal power plants, and to private utilities in the Missouri Basin.

Fort Randall Dam, which is on the Missouri, 75 miles southwest of Mitchell, S.D. is about 75 percent completed. Other Missouri River dams under construction are the Gavins Point Dam (scheduled to go into operation in 1956) south of Fort Randall Dam, and Oahe and Garrison dams to the north of Fort Randall.

Industrial College of Armed Forces Invites Participation

Members of ASCE are invited to enroll in the high-level educational program of the Department of Defense being carried out by the Industrial College of the Armed Forces. Both the Extension Courses Division and the resident course at the college are dedicated to the education of selected military and civilian students in the general field of national resources—human, economic and materials—and their coordination for the security of the nation.

The Extension Courses Division of the college includes two branches—a Correspondence Study Branch and Civilian-Reserve Instruction Branch. Each year the Civilian-Reserve Instruction Branch conducts National Resources Conference in sixteen different cities, each of two-week duration. In these conferences an objective study is made in broad terms of the economy of the United States and the free world, and the limitations imposed by it on our national aims and objectives. The Correspondence Study Course extends and details the instruction given during National Resources Conference studies in the field of economic coordination. This course, which requires a year to complete, is currently enrolling 1,800 students, 500 of whom are civilians.

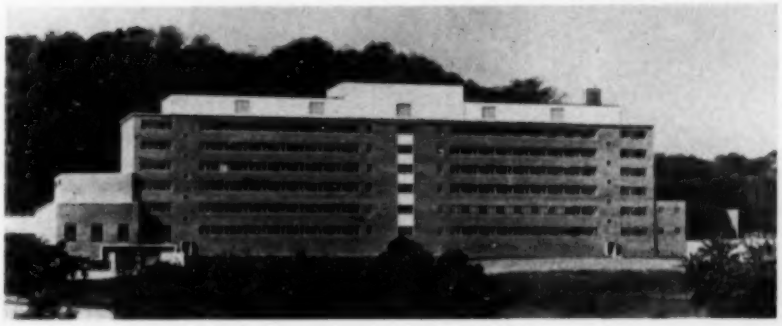
Further information may be obtained from the Industrial College of the Armed Forces, Extension Courses Division, Fort Lesley J. McNair, Washington 25, D.C.

Engineer Board Approves Warrior River Reservoirs

The River and Harbor Board in Washington, D.C., has approved a plan for constructing multiple-purpose reservoirs on the headwaters of the Warrior River, according to an announcement from the Mobile District Engineer. It recommends the adoption of a general plan of improvement, including construction of three multiple-purpose reservoirs—the New Hope Dam and Reservoir on Sipsey Fork, the Smiths Ford Dam and Reservoir on Locust Fork, and the Dorsey Creek Dam and Reservoir on Mulberry Fork—and the addition of power installations at Dams 17 and 13, when the latter dam is reconstructed under the modernization program for the Warrior-Tombigbee Waterway.

Principal needs of the area are the control of floods and the increase of minimum flows for navigation (including lockages), pollution abatement, and water supply for industrial uses. The plan recommended by the Engineer Board is designed to meet these needs, and also to make use of the reservoir projects to produce power. Before any construction can be undertaken, the plan must be approved by the Chief of Engineers and authorized by Congress.

Public Health Service Opens Research Center



New $4,000,000 building in Cincinnati, Ohio, which will house the Sanitary Engineering Center of the U.S. Public Health Service, was dedicated by Mrs. Oveta Hobby, Secretary of the Department of Health, Education, and Welfare, on April 8. The center, until recently the Environmental Health Center, is the focal point for government research into how the health of human beings may be affected by contact with elements found in air, water, and food, and by radiation and other environmental factors. Gordon M. Fair and Abel Wolman, Members ASCE and professors of sanitary engineering at Harvard and Johns Hopkins universities, respectively, presented the role of engineering in a two-day program of talks dealing with various aspects of man's efforts to control environmental factors, which opened the research and training center.

Weight-Saving Floor Construction Used in Denver Skyscraper

Denver's 23-story Mile High Center, scheduled for completion this summer, will save approximately 30 percent of floor dead load and reduce structural steel and foundation requirements through the use of air-entrained, lightweight, structural concrete floors reinforced with draped welded wire fabric. The new skyscraper is one of the first large buildings in the Rocky Mountain area to feature this modern weight-saving floor construction. The 4-in.-thick poured concrete floor slabs incorporate an expanded clay aggregate, graded 0 to $^{3}/_{4}$ in., and are designed to develop a strength of 2,500 psi in 28 days. The 3×16 $^{6}/_{10}$ welded wire fabric is draped continuously over the 8-ft, 4-in. spans, affording negative reinforcement in the area above the beams, and drooping to near the hung plywood forms to furnish positive reinforcement in the mid-span area. The saving in cost results not only from the use of lightweight aggregate in thin slabs, but also from the saving in reinforcement steel area that welded wire fabric affords. The consulting engineers on the project, the New York firm of Severud-Elstad-Krueger, reduced reinforcement steel by allowing stresses up to 29,000 psi. Webb & Knapp, Inc., are designers of the project and co-developers with the general contractor, the George A. Fuller Co.

Modern Blasting Techniques Speed Work on New York State Thruway

Thruway Section before blasting is shown in the left-hand view. Closeness of the houses to the cut should be noted. The upper photo shows the same area immediately after the blast, with the hard rock crushed and the houses unscathed.

Intelligent use of modern explosives has enabled the general contractor for the Suffern section of the New York State Thruway—L. G. De Felice & Sons, Inc., of North Haven, Conn.—to prepare over 13,000 tons of rock, in one shot, for removal by power shovel, despite the fact that the section is only 25 ft from Suffern dwellings. There was also the additional hazard that the rock to be removed rose from 50 to 75 ft above the houses, and that it consisted of hard granite and trap rock.

The rock is being blasted in two passes. The first pass, which was about 60 ft wide or half the total width of the finished highway, constituted the side of the highway away from the dwellings. After the rock broken in the first pass has been removed, the second half, closer to the houses, will be dynamited. The explosives are timed in such a way that the broken rock will be thrown away from the houses. The explosive used is the Atlas Powder Company's Gelodyn No. 3 ($1^1/_2$ in. in dia by 8 in. long), set off by milli-second-delay Rockmaster blasting caps. About 100 holes, spaced on 6-ft centers, are shot at one time, each hole averaging 24 ft deep with 12 ft of sand stemming on top. Over half a ton of explosives is shot at once without any flying rock, and the residents of Suffern are generally unaware that blasting is going on.

Use of the milli-second-delay Rockmaster caps easily controls the direction of throw, the delays used ranging from No. 1 to No. 9. The shorter delays (8–25 milli-seconds) are placed to break first so that the longer delayed charges (up to 200 milli-seconds) will move the rock in the direction of the already broken material. Needless to say, the direction of rock movement is away from the houses.

Pittsburgh Water Resources Found Ample But Polluted

Despite tremendous demand, sufficient water is available in the Pittsburgh area to satisfy current needs without difficulty, according to an announcement made by Secretary of the Interior Douglas McKay in releasing a recent report of the Water Resources Division of the Geological Survey. Per capita water use in the Pittsburgh area during 1951 amounted to twice the average per capita use for the State of Pennsylvania. An average of 3,040 mgd was withdrawn from the streams and wells each day, the equivalent of 2,000 gal per person. The use of ground water in the area has doubled in the past two decades.

Local droughts are found not to affect Pittsburgh supplies seriously because the major water supply systems depend more on the large rivers than on local precipitation. However, as the flow decreases, the water becomes more acid and contains a higher concentration of dissolved solids. Stream pollution is a major problem, with acid mine drainage presenting the greatest single problem at the present time because no practical means of eliminating it has been found. Of the rivers in the area, Monongahela River waters were found to have the greatest acid concentration and Allegheny River waters the least. At present more attention is being given to improvement of the quality of available supplies than to the development of new supplies.

Free copies of the 56-page report, which is being issued as Geological Survey Circular 315, may be obtained from the Chief of Distribution, Geological Survey, Washington 25, D.C.

Caterpillar Tractor To Have New Plant

Site preparation work for a new Caterpillar Tractor Co. plant to be built at Decatur, Ill., has begun, following award of a contract to the construction firm of Jansen & Schaefer, of Pekin, Ill. The contract includes all earth excavation, filling, and grading, and also foundations for the heating plant and manufacturing building and for a tunnel that will connect the two structures. The manufacturing building will provide some 730,000 sq ft of floor area. Structural steel for the project will be furnished and erected by the Mississippi Valley Steel Co., of Decatur.

New Toll Equipment for Pennsylvania Turnpike

All terminals and interchanges on the 360-mile Pennsylvania Turnpike will be equipped with entirely new toll facilities in the fall of 1955, according to an announcement from the Pennsylvania Turnpike Commission. The new toll collection and audit system is a combination of photoelectric "eyes," specially designed weighing platforms, and toll recorders which is expected to result in greater operating efficiency, increased revenue protection, and better vehicle classification.

The system, which will require no change in procedures now followed by drivers using the turnpike, features electronic devices that both count the number of axles on each car or truck entering the turnpike and weigh the vehicles while they are being driven up to the toll booth. The principle of weighing while the vehicle is in motion and basing its classification on its total weight is considered desirable for determining toll charges.

Used in connection with the new interchange equipment will be the newest electronic "brain," which in addition to doing the turnpike's bookeeping, will compile traffic density data to show which interchanges are busiest.

ASTM Award to Honor Memory of F. E. Richart

Establishment of an award in honor of Frank E. Richart, M. ASCE, who died in 1951, is announced by the American Society for Testing Materials. The award, consisting of a suitably engrossed certificate and an honorarium, will be given for outstanding technical investigations in the field covered by ASTM Committee C-9 on Concrete and Concrete Aggregates, of which Mr. Richart was chairman. Mr. Richart also served the ASTM as officer and longtime worker, and was an honorary member.

British Columbia Power Project Starts Operation

The first of two units of the Waneta hydroelectric power station, each consisting of a 120,000-hp water wheel driving a 75,000-kw generator, has just been placed in operation at Waneta, B C Designed and constructed by Stone & Webster, Canada, Ltd., in collaboration with Stone & Webster Engineering Corp., Boston, the new plant is owned by the Consolidated Mining & Smelting Company of Canada, Ltd., Trail. B.C. Power provided by the project, which is located on the Pend d'Oreille River, just north of the United States border, will feed into the network of the company, which already owns and operates four hydroelectric plants in British Columbia.

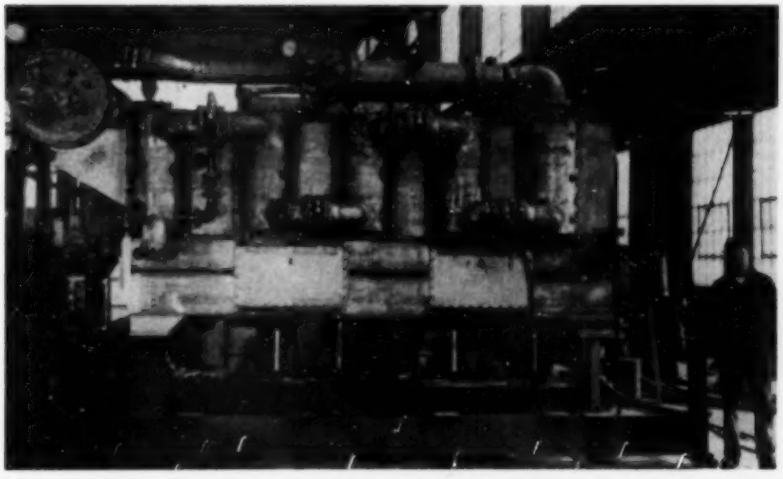
The dam is a gravity-type structure, 950 ft long and 250-ft maximum height. Space is provided in the powerhouse for two additional units of the same capacity as the two being installed.

U.S. Steel Begins New Delaware Valley Plant

Construction of a third new steel plant in the Delaware Valley was begun by the United States Steel Corporation on April 6, when ground was broken for a new steel products plant on a 27-acre plot along the river in Pennsauken Township just north of Camden, N.J. The plant, which will be completed early next year, is designed for the production of steel drums and pails for the petroleum, chemical and other industries. It will have 168,000 sq ft of floor space, and will be the most modern of its kind in the world. The Philadelphia firm of Stofflet & Tillotson is general contractor.

Two other U. S. Steel plants in the Delaware Valley were completed last year and are now in production—the Fairless Works in Bucks County and the National Tube Division facility on the Upper Delaware.

Flash-Type Distilling Plant Is Built for the Navy



Largest flash-type distilling plant for producing fresh water from sea water built up to this time has recently been completed by the Griscom-Russell Co., of Massillon, Ohio, after designs developed by the Central Technical Division of the Bethlehem Steel Co. The unit is said to represent new achievements in economy, weight and space, and maintenance. The unit will be shipped to the U. S. Navy after outfitting and the customary testing at the Bethlehem Quincy Yard.

Nuclear Notes

I—Role of the Civil Engineer

To stimulate interest in the field of nuclear energy, the ASCE Sanitary Engineering Division, through its Committee on the Sanitary Engineering Aspects of Nuclear Energy, has agreed to prepare a monthly column for "Civil Engineering." Conrad P. Straub, of the Oak Ridge National Laboratory, is chairman of the committee. Questions or answers from the membership with regard to the various problems relating to the application of atomic energy will be welcome. Next month's subject will be: "Measurement of Soil Density and Moisture in Place, Tracer Applications."

The Atomic Age dawned on December 2, 1942, under the watchful eyes of scientists gathered beneath the West Stands of Stagg Field, at the University of Chicago. Here, on a practical scale, was the first harnessing of the tremendous energy liberated in the splitting of the nucleus of the atom. The success of that demonstration and the developments that have taken place since are known to all.

The civil engineer has played a prominent role in the development of the nuclear energy field. He had to meet the challenge of designing and constructing plants of unprecedented size to process the raw uranium ores into fissionable materials, and of planning and building towns such as Oak Ridge, Los Alamos, and Richland, which house the personnel needed to staff the Atomic Energy Commission installations at these sites. From this it might be assumed that the outlook for civil engineers in the field of nuclear energy is limited to construction, but such is not the case. In the past most nuclear problems were referred to the Atomic Energy Commission and its contractors for solution, leaving little opportunity for the practicing engineer. However, this is no longer true, particularly in view of the increased emphasis that is being placed on the development of power from nuclear reactors. Five separate teams (including ten firms from private industry) have made or are making studies of nuclear power reactors—studies which have cost them more than $1,000,000, and which may result in the private development of nuclear power on a competitive basis.

The sanitary engineer has found a definite niche in the field of nuclear energy. Because of his ability to appraise problems of water supply, waste disposal, and environmental sanitation in terms of permissible levels of contamination, he is actively engaged at many sites in a study of the problems of radioactive waste disposal and the effect of these wastes on the environment and economy of man. Sanitary engineers and other civil engineers have been consulted in mat-

ters regarding the selection of sites for atomic energy installations, the design and building of structures and facilities, and research and development associated with the control of the environmental problems resulting from the release of the waste materials.

Another field of activity of interest to all engineers is that of the application of tracer techniques (use of marked or labelled isotopes) for studying in detail many of the problems in fluid mechanics, sanitation, soil mechanics, structures, etc. Structural engineers may be faced with the problem of the effect of high levels of radiation on materials of construction. In fact, it is hard to conceive of research or activity in any branch of engineering that cannot benefit from the use of radioactive materials as additional tools of study. The field is challenging and unlimited.

The AEC, through its Division of Engineering, has been very active in contracting with engineering educational institutions to study specific problems of waste disposal and water supply. One of the by-products of these efforts has been the training of young engineers who will be in a position to meet the problems of this new era. Of course, the numbers trained are relatively small.

That the American Society of Civil Engineers has been aware of its responsibilities to keep its membership informed on developments in the nuclear energy field is seen from the following record: Since 1949, eight articles and two symposia have been published in CIVIL ENGINEERING on various aspects of nuclear energy including the training of engineers, civil defense, design of buildings to withstand atomic blasts, structural shielding for the protection of personnel and equipment, effects on water supply and sewage treatment, and potentialities of nuclear power. A report of the Society's Committee on Atomic Energy was published in December 1953.

In the presentations to follow, in spite of new nomenclature the civil engineer will recognize much which is already familiar to him, and nuclear physics and chemistry will lose their awe. The purpose of the articles will be not to teach nuclear physics but to provide an understanding of the language, terminology, and principles needed to serve as background material for the successful application of nuclear energy to our particular problems and the application of our engineering skills to the problems of nuclear energy.

Data on Landslides Sought

Help in compiling a volume on "Landslides and Engineering Practice" is requested by the Committee on Landslide Investigations of the Highway Research Board. In preparation for the past two years, the volume is intended primarily for railroad and highway engineers, though it will probably be useful to all engineers and geologists whose work concerns landslides in any way.

To make the volume as comprehensive as possible the committee has designed a questionnaire covering all phases of the subject from economics to prevention and correction of slides, which is being sent to all highway departments and other interested groups. The committee would also like to have additional facts from all engineers and geologists, whether they have data on one or many slides and whether their information is general or specific. Requests for copies of the questionnaire should be addressed to Seward E. Horner, chief geologist, State Highway Commission of Kansas, Topeka, Kans.

N. G. Neare's N* COLUMN

R. ROBINSON ROWE, M. ASCE

Esseyeville was practically normal again, the Convention had come and gone, the big shots were back in Lexington, Houston, New York and La Mesa, and all the business before the Engineers Club was explanation and post-funding of the inevitable deficit. Some blamed the weather or a competitive lecture by Dr. Kinsey, but the prevailing post-mortem was Professor Neare's, "It was worth it!" as he called on Guest Prof. M. T. Tank.

"Of course it was worth it," echoed M.T., "but I wish I had had a model there to demonstrate my problem of the Battle of the Tanks. This sketch (Fig. 1) will have to do. It shows the situation at the end of the first minute, with Tank A drawn down 5.75 ft from the 36-ft mark when the valve of B was opened and . . ."

"And B's jet pushes the disk over against A's orifice," interrupted Joe Kerr, "where it stays for a minute until B is drawn down to A's level. Then the two jets balance the disk midway between orifices, and both tanks discharge neck-and-neck down to the 4-ft mark. So it's really a Battle of the Jets, isn't it?"

"Well, I . . ."

"Thanks," continued Joe. "Now we all know that $T = k\sqrt{H}$ expresses total discharge time for a tank from the H-ft mark if k is evaluated from sections of tank and orifice, so that $t = k(\sqrt{H} - \sqrt{h})$ is the duration of discharge from H down to h. So:

$$1 = k(\sqrt{36} - \sqrt{36 - 5.75}) = {}^1/_2k$$

Then, with $k = 2$, duration of the neck-and-neck battle is

$$t_n = 2(\sqrt{30.25} - \sqrt{4}) = 7,$$

which must be added to the first 2 min to make 9 min, the answer."

"The boy is clever," conceded Cal Klater, "but not smart. When he found the formula for discharge of a tank, if he had looked in the next chapter of the book he would have found that the momental pressure of a jet on a flat plate is twice the static pressure which produced it. So, in spite of the valve being opened at $T = 1$, B can't discharge until A is drawn down to the 18-ft mark. Then A is shut off and B runs down to the 9-ft level, where it is stopped while A resumes and runs to 4.5. In the last round, B runs from 9 to 2.25 and stops while A runs from 4.5 to 4.0 and the end of the battle. Computing each run by Joe's formula, the times add to 17 min."

"Which," concluded Professor Tank, "is simply

$$T = 2(\sqrt{36} - \sqrt{4}) + 2(\sqrt{36} - \sqrt{2.25}) = 8 + 9 = 17$$

if we collect the interrupted runs of A and B according to the principle of 'e pluribus duo'."

"Tanks or jets, it was a nice battle," grinned Professor Neare, "but it would have run to a debilitative anticlimax if you hadn't stopped it.

"Speaking of battles reminds me of the Pentagon Building, or rather of some pentagonal tiles that were not needed there. My close friend, Mac McMack, bought some for his bathroom floor, paying $4/M at a war-surplus sale, telling me also that they had the same close fit, fine polish and $^3/_4$-in. edges as hexagonal tiles costing $6.25. He asked me what I'll ask you: 'How good a buyer is he?' "

[Guest Professor Tank was Julian Hinds and Cal Klaters were: Ed C. Holt, Jr., Ignor Antenuff (Paul Hartman), Joseph R. Reed, and Stoop (John L. Nagle). Also acknowledged are solutions of February's yawarafathon from Holt and Adolph A. Marrone.]

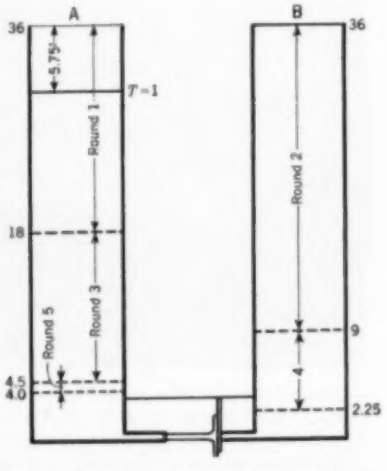


Fig. 1. Tank A leads in Round 1, but B will be ahead when time is called in Round 5.

Assignment:

Take a picture of tomorrow!

What will be the face of tomorrow's world? Where will its highways and rail lines lead? What will be the direction and design of its industrial growth?

AERO surveyors take off each day to find the answers in all these and other fields. For tomorrow's plans demand maps today . . . maps of precision accuracy, delivered with speed that comes only with air survey methods.

This modern AERO organization of trained flight crews, engineers and cartographers, working with the world's finest mapping instruments, is hastening the completion of large scale mapping projects at home and abroad. Let us show you how we can help advance your plans for tomorrow, at big savings in money and manpower.

AERO SERVICE CORPORATION

Philadelphia 20, Pennsylvania

AIRBORNE MAGNETOMETER SURVEYS
PRECISE AERIAL MOSAICS • TOPOGRAPHIC MAPS
PLANIMETRIC MAPS • RELIEF MODELS • SHORAN MAPPING

Oldest Flying Corporation in the World

Affiliates:
AERO SERVICE CORPORATION *(Mid-Continent)*, TULSA
AERO SERVICE CORPORATION *(Western)*, SALT LAKE CITY
CANADIAN AERO SERVICE, LTD., OTTAWA

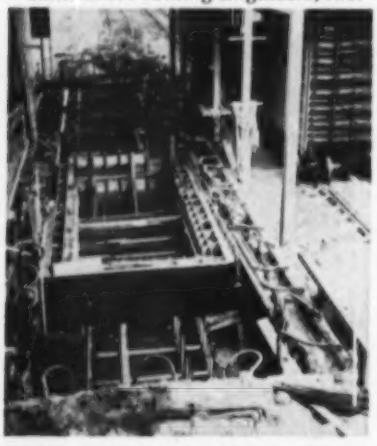
HOW TO HANDLE
WET JOBS

#27 of a Series

"TRACK SCALE"
PIT

Delmar, Delaware

Contractor: Milling Engineers, Inc.



WELLPOINTS RACE TO RESCUE WHEN BOTTOM BOILS

AT 4 FT. above subgrade, the bottom of this excavation began to heave and boil dangerously. A hurry-call went out; by morning Griffin engineers had raced 250 miles to what was clearly a "toughnut" situation—digging at a standstill — hole sheeted on 3 sides — sandwiched between building and siding, with low-ceiling track-shed overhead.

• Lurking below subgrade was the culprit of the case—a layer of quicksand under excess hydrostatic pressure. Fast action was urgent. Within 4 working days, planning, shipping, installing were all completed and the situation under control. Contractors finished a bone-dry job on schedule—with money savings.

• When every hour counts, you can count on Griffin for quick, dependable service.

GRIFFIN
WELLPOINT CORP.
881 East 141st Street, New York 54, N. Y.
Hammond, Ind. Houston, Tex. Jacksonville, Fla.
In Canada: Construction Equipment Co., Ltd.
Toronto Montreal Halifax

DECEASED

James Stuart Anderson (A.M. '43), age 41, since 1948 chief engineer and general superintendent of the Robert G. Regan Co., Joliet, Ill., died in Evanston, Ill., on February 19. From 1946 to 1948 Mr. Anderson was village engineer and building commissioner of Wilmette, Ill. Earlier he had been employed by the Philco Radio and Television Co., and Windes and Marsh, Winnetka; Warren and Van Praag, Decatur; Charles De Leuw, Chicago; and Harland Bartholomew, St. Louis. He graduated from Northwestern University in 1934.

Harold Kilbrith Barrows (M. '08), age 80, professor emeritus at Massachusetts Institute of Technology and nationally recognized authority on hydraulic engineering, died at Winchester, Mass., on March 15. An 1895 graduate of MIT, Professor Barrows joined the faculty as associate professor of hydraulic engineering in 1909, advancing to a full professorship in 1921. He retired in 1941. He had been associate professor of civil engineering at the University of Vermont (1901–1904) and district engineer for the U. S. Geological Survey in New York and New England (1904–1909). Since 1907 Professor Barrows had also maintained a private practice in Boston, acting as consultant to many New England cities and states.

George Frederic Brockman (M. '44), age 67, of Louisville, Ky., died in that city on February 18. Mr. Brockman was with the U.S. Engineer Department in 1910 and 1911, 1921 and 1922, and from 1939 until his retirement in 1948. Intermittently he was with the Metropolitan Sewer District of Louisville, which he served a total of 19 years. Mr. Brockman studied at the University of Kentucky.

Frederick William Carlson (A.M. '23), age 60, retired engineer of San Diego, Calif., died in that city on February 24. At various periods Mr. Carlson had been resident engineer and superintendent of construction for several Boston engineering firms, including Chas. T. Main, Inc., Metcalf & Eddy, and Whitman and Howard. Prior to his retirement he was a hull inspector for the U.S. Maritime Commission at National City, Calif.

George Wilkinson Case (A.M. '10), age 73, former dean of the College of Technology and director of the Engineering Experiment Station at the University of New Hampshire from 1925 to 1942, died on November 7. An alumnus of Purdue University, Mr. Case was an instructor and assistant professor there from 1906 to 1911, and assistant, associate and professor of sanitary engineering, and superintendent of buildings and grounds at the University of Pittsburgh from 1912 to 1917. Before going to the University of New Hampshire he was associated with Morris Knowles, Inc., and the American City Engineering Co., Pittsburgh, Pa. During World War II, Mr. Case served as director of Engineering Science Management War Training, U.S. Office of Education, Washington, D.C.

Ernest Truman Cavitt (J.M. '52), age 23, second lieutenant in the Army Corps of Engineers at Fort Belvoir, Va., died recently. Lieutenant Cavitt entered the service immediately after graduating from the Agricultural and Mechanical College of Texas in 1952 with the degree of bachelor of science.

Leland Clapper (M. '19), age 67, former chief engineer of the Duluth, Missabe & Iron Range Railway Co., Duluth, Minn., died at Tulsa, Okla., on November 19. Mr. Clapper retired in June 1952 after 43 years of service (nine as chief engineer) with the Duluth line. He was a graduate of Iowa State College and the Massachusetts Institute of Technology.

Arthur Coleman Comey (M. '25), age 67, city and regional planning consultant of Lincoln, Mass., died on January 26. Engaged in private practice since 1911, Mr. Comey was consultant to the National Planning Board, National Resources Committee and National Resources Planning Board, and zoning adviser to many New England municipalities. From 1930 to 1941 he was an assistant and associate professor and lecturer at Harvard University, his alma mater.

Arthur Chrisfield Dennis (M. '01), age 87, who had been living at Salisbury, Md., since his retirement in 1944, died there on February 20. After graduating from Lafayette College in 1887 he was employed by various Eastern railroads; served as district engineer for the Canadian Pacific, Grand Trunk Pacific, and the Western Pacific railroads; and was contract manager for Foley, Welch & Stewart, on work for several Canadian lines. Beginning in 1919 Mr. Dennis was a consultant and contractor on tunnel construction throughout the United States, Australia and New Zealand, engaged in such projects as the Hetch-Hetchy Tunnel in San Francisco, hydroelectric tunnel projects in California and North Carolina, and tunnels for the Delaware Aqueduct system.

John Walter Fairlie (A.M. '17), age 71, retired engineer of Ottawa, Ontario, Canada, died there on November 23. For several years prior to his retirement Mr. Fairlie had been technical officer in the Department of Reconstruction and Supply of the Dominion of Canada. He held the degree of bachelor of science in engineering from the University of London.

James Frankland (M. '29), age 65, former regional engineer in the U.S. Forest Service, at Portland, Oreg., died in that city on March 12. With the exception of two years as a bridge specialist with Redrick & Kraemer, of Portland, Mr. Frankland devoted his entire career to the Forest Service. Joining the Service in 1913, he became attached to the Portland office in 1924; was appointed assistant regional forester in 1936; and retired in December 1951. He was an alumnus of the University of Washington.

Edgar Raymond Frisby (M. '15), age 75, retired engineer and alumnus of Lehigh University, died in Washington, D.C., on January 10, 1953. In government service

from 1898 to 1933, Mr. Frisby was with the U.S. Naval Observatory, Washington, D.C.; the U.S. Coast and Geodetic Survey (as an aid and later head of computing division of the Manila office); and with the Bureau of Standards, Washington, D.C. Beginning in 1934 he was associated with Fairchild Aerial Surveys, and Leeds, Hill, Barnard and Jewett, both of Los Angeles, and Stone and Webster at Velasco, Tex.

Yum-Chuen Fu (J.M. '53), age 23, graduate assistant for the Joint Highway Research Project at Purdue University, died on February 15 as the result of an automobile accident near Lebanon, Ind., on January 23. Mr. Fu, who graduated from the Virginia Military Institute in June 1953, had been engaged in graduate work at Purdue since September 1953.

Neil Haig, Jr. (J.M. '46), age 34, engaged in the contracting business at Fresno, Calif., since 1948, died recently. Mr. Haig graduated from the University of Washington in 1941 and served as an officer in the Army Coast Artillery Corps and the Field Artillery Corps for five years. Before entering his own business, he had worked for W. D. Day, architectural engineer of San Francisco, and the Elliot Bay Lumber Co., Seattle, Wash.

Robert Bruce Morrison Hanes (J.M. '52), age 22, lieutenant in the U.S. Air Force, at Graham Air Force Base, Marianna, Fla., died on March 10. Lieutenant Hanes entered the service following his graduation from Virginia Military Institute in June 1952.

Clair Allen Inskeep (M. '18), age 70, division right-of-way engineer for the Ohio State Department of Highways at Bellefontaine, Ohio, died on March 10. During a career devoted to public service, Mr. Inskeep acted as city manager for Melbourne, Fla., city manager for Bellefontaine, and county engineer for Logan County, Ohio.

Roy Caradoc Jones (M. '28), age 65, who retired in 1945 as principal engineer for the U.S. Department of Engineering in the Panama Canal Zone, died on October 10. Mr. Jones was named principal engineer in 1937, after serving as assistant to the district engineer of the Canal, continuously for thirteen years. He had previously (1908-1917) worked on surveys and fortifications for the Canal.

Walter Lewis Leach (M. '35), age 53, partner in the consulting engineering firm of Havens and Emerson, New York and Cleveland, died at his home in West Orange, N.J., on March 5. Associated with Havens and Emerson (and its predecessor, Gascoigne & Associates) since 1923, Mr. Leach was admitted to partnership in 1951. He attended Ohio State University and worked for a brief period in the engineering department of the Cleveland Sewage Division.

Samuel John Leonard (A.M. '27), age 58, professor of civil engineering at the Drexel Institute of Technology and member of the faculty there since 1925, died in Philadelphia, Pa., on March 8. Earlier he was con-

(*Continued on page 98*)

Three Hundred and Fifty Days

in a Man-Made Dust Storm

We create this dust storm in a sealed chamber. Within it, Brunson instruments are bombarded by fine pumice dust borne by a constant gale of wind. The instruments are rotated continuously during the test.

Even after 'round-the-clock exposure to such extreme conditions for eleven and a half months, the accuracy and operability of Brunson instruments is unimpaired.

What better proof can there be that Brunson dustproof, ball bearing construction offers the answer to your three big headaches with surveying instruments—binding caused by dirt, inaccuracy caused by wear between moving parts, and costly maintenance to overcome the effects of dirt and wear?

In Brunson instruments, dirt is sealed out, the lubricant sealed in, and wear is practically eliminated by the smooth ball bearing action in the spindle and telescope axis. They maintain lasting accuracy—without costly routine repair . . . loss of time on the job through malfunctioning . . . or adjustment to compensate for errors.

They cost no more—offer *lots* more. Write today. You'll be glad you did!

BRUNSON
The New Standard of Excellence

DISTRIBUTED EXCLUSIVELY BY
BRUNING
Everything for the Engineer and Draftsman

CHARLES BRUNING COMPANY, INC. • 4700 MONTROSE AVENUE • CHICAGO 41, ILLINOIS

PIPE WITH A "ONE-TWO" PUNCH

Naylor light-weight pipe is your best bet to "knock out" gas, fumes and stale air in underground operations. In push-pull ventilation, it gives you a "one-two" punch that can't be matched in the light-weight class because no other light-weight pipe has Naylor's exclusive lockseamed-spiralwelded structure. The extra collapse strength provided by this structure makes it possible to build Naylor vent pipe of lighter gauge material without any sacrifice of performance. Other savings are assured through use of the Naylor one-piece Wedge-Lock Coupling—the quickest possible connection available today.

Write for Bulletins No. 507 and No. 514 to get the full story on this unbeatable Naylor combination.

NAYLOR PIPE

Naylor Pipe Company • 1281 East 92nd Street, Chicago 19, Illinois

Eastern U.S. and Foreign Sales Office: 350 Madison Avenue, New York 17, New York

Deceased

(*Continued from page 97*)

nected with the Raymond Concrete Pile Co., the B. F. Goodrich Co., the Pennsylvania Department of Highways and Columbia University. Professor Leonard was a veteran of World War I. He received his civil engineering degree from Cornell University in 1917.

Charles McConnell Lightburn (M. '27), age 69, who retired from the Denver & Rio Grande Western Railroad this past February after 40 years of continuous service, died in Denver, Colo., on February 28. At various times Mr. Lightburn held the posts of valuation, project, assistant chief, and industrial engineer. He was a member of the Colorado State Planning Board, and the Denver City Planning Commission. He attended the University of Colorado.

William Duncan Malcolm (M. '45), age 70, former secretary and chief engineer of J. Rich Steers, Inc., New York, N.Y., died in April 1953. Mr. Malcolm was with Henry Steers Inc., from 1911 to 1929, advancing from superintendent to chief engineer. From 1930 until his retirement in 1948 he was with J. Rich Steers, Inc. He was a graduate of Yale University, class of 1902.

Charles Augustine Maguire (M. '40), age 66, founder and senior partner in Charles A. Maguire & Associates, Providence, R.I., died in that city on March 24. From 1911 to 1933, Mr. Maguire was a member and president of the Charles B. Maguire Co., a building firm founded by his father. He then served as Commissioner of Public Works for Providence and chairman of the Metropolitan Sewer Commission. In 1937 he organized Charles A. Maguire & Associates, which has been engaged on the design of the Mystic River Bridge at Boston, naval installations at Newport and Quonset Point, R.I., the proposed Freeway through Greater Providence, and the Tiverton-Portsmouth Bridge.

Erich Moore Plump (A.M. '16), age 69, retired engineer of Manhasset, N.Y., died on November 6. A 1904 graduate of Pratt Institute, Mr. Plump was employed by several New York architects in the early part of his career. For more than 20 years he was associated with the Matthews Construction Co., of New York, advancing from superintendent to vice-president and director of the firm. After that (from 1945 until his recent retirement) Mr. Plump was with Sanderson & Porter and John W. Harris Associates, Inc., both of New York.

Neal Frederick Pophal (J.M. '52), age 23, engineer in the La Crosse (Wis.) Engineering Department, died in December 1953. Mr. Pophal joined the department shortly after graduating from the University of Wisconsin in June 1952.

Sherman George Swigart (M. '20), age 88, head of the Akron, Ohio, engineering firm, S. G. Swigart & Sons, died recently. Before entering private practice in 1917, Mr. Swigart was assistant city engineer of National City, Calif., surveyor for Summit County, Ohio, and locating and resident engineer for several Western railroad lines.

Eugene Lingenfelter Williams (M. '37), age 62, director of the Inspection Division, 11th Naval District, District Public Works Office, San Diego, Calif., died on February 14. In his early career, Mr. Williams was with the U.S. Coast and Geodetic Survey, and Clark E. Jacoby Engineering Co., Kansas City, Mo. He had a consulting practice in Kansas City from 1927 to 1935, and then served the Missouri State Building Commission as superintendent of construction and chief engineer for six years. During the war years Mr. Williams was in the Bureau of Yards and Docks, serving in Baltimore, San Pedro, and San Diego. He was a graduate of the University of Missouri.

NEWS OF ENGINEERS

S. C. Hollister, dean of the college of engineering at Cornell University, was elected a director of the Raymond Concrete Pile Co., New York, N.Y., at its annual meeting on April 7.

L. E. Hough, former city engineer of Aberdeen, Wash., and partner in the firm of Rowe & Hough, has accepted a resident engineering job with the Alaska Road Commission at Juneau.

Ford, Bacon & Davis of New York, Chicago, Los Angeles, Toronto, and Monroe, La., is celebrating its sixtieth year in the engineering and construction field.

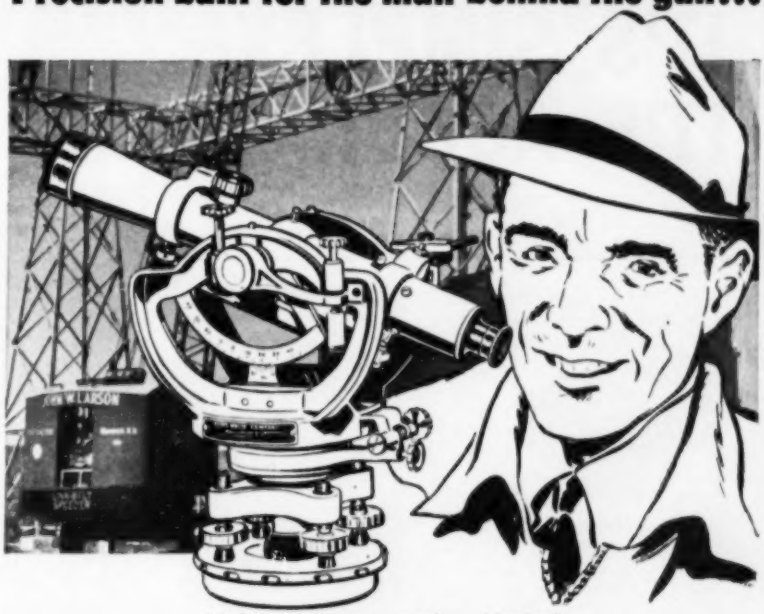
Carlin H. Whitesell, colonel and executive officer, Eastern Ocean Division, Corps of Engineers, Richmond, Va., is being transferred to duty at the Army War College, Carlisle Barracks, Pa.

Douglas S. Trowbridge, professor of civil engineering at New York University, will retire in June after 44 years on the faculty—the longest tenure of any N.Y.U. staff member. Professor Trowbridge was honored at a testimonial dinner on March 20 and presented with the first Trowbridge Medal, struck in gold. The faculty has established a fund to present the medal to an outstanding civil engineering student every year. Professor Trowbridge has been director of the engineering surveying camp for 31 years and for many years served as faculty adviser to the ASCE Student Chapter.

D. S. Trowbridge

(*Continued on page 100*)

Precision-built for the man behind the gun...



Model 3000 $195.00* complete with tripod.

White gives you the most practical Universal Level-Transit on the market!

HERE'S a Universal Level-Transit specially developed to handle all survey and checking operations. It's sturdy, accurate and exceptionally easy to use. And — a new single truss standard frame design replaces old-style cross bars and wyes. What's more it has a silvered 4¼" horizontal circle with easy to read 5 minute vernier.

Other advantages of this outstanding instrument include coated optics, internal focusing and a ball-bearing race for smooth operation even in sub-zero weather. Check out a White on your next trip and discover how much easier your work can be. Write for DAVID WHITE Bulletin 1053, and name of your nearest dealer. 359 W. Court St., Milwaukee 12, Wis.

Speed all these and many other operations

- finding differences in elevation
- determining grades for building
- laying out lots and foundations
- running lines for curbs and sidewalks
- aligning foundation piers
- plumbing walls and uprights
- checking walls under construction
- ascertaining slopes for tiling
- relocating lost surveying monuments

DAVID WHITE COMPANY

We offer expert REPAIR SERVICE on all makes, all types of instruments

* Prices subject to change without notice.

IT'S SIMPLEX— IT'S ACCURATE

Reliable measuring and controlling equipment

AIR RELEASE VALVES
Vent air accumulations to eliminate air binding at high points and increase pumping efficiency. Simple, rugged 1" and 2" sizes for up to 250 p.s.i. Special valves available for up to 800 p.s.i.

AIR INLET VALVES
Prevent collapse of thin-walled pipes with sudden pressure drops in gravity lines. Simple, reliable float control quickly admits air to break vacuum. Available in 4" to 10" sizes.

PITOT EQUIPMENT
Leaks and line breaks are quickly located with Simplex pitot rods, manometers and recorders. Light-weight, compact design makes them truly portable. Invaluable for overall survey of distribution system's efficiency.

VENTURI TUBES for accurate measurement of hot or cold water, gases, air, sewage, sludge or trade wastes under a wide range of pressures. Available in many sizes and designs — in cast-iron, cast steel or steel plate, bronze or combinations to suit your needs.

FILTER GAUGES indicate and/or record essential data on rate of flow, loss of head and sand expansion. Furnished for operating table or floor stand mounting.

TYPE H METER—Mercury-float type indicating, recording and totalizing unit. Gives ±2% accuracy at any point over flow ranges as wide as 13 to 1. Evenly spaced gradations make accurate readings easy. Available for wall, panel, or floor stand mounting.

FLOW CONTROLLERS
Maintain constant flow regardless of variations in head of filter effluent or wash water. Control within ±3% over 5 to 1 range. Exclusive, balanced guillotine valves quickly respond to slightest pressure differential. Standard sizes from 3" to 24".

Interesting Bulletins
Write for full details today
Simplex Valve & Meter Co.
6724 Upland St., Phila. 42, Pa

SIMPLEX®
VALVE AND METER COMPANY

News of Engineers

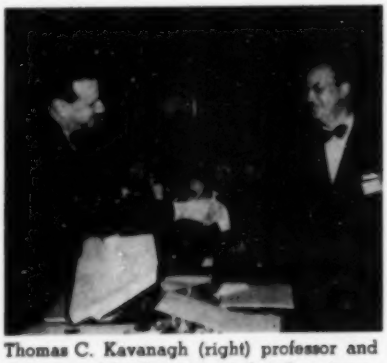
(*Continued from page 99*)

Stanley J. Johnson recently became associated with Moran, Proctor, Mueser & Rutledge, Consulting Engineers, New York, N.Y., and is currently participating in their foundation evaluation and design studies for a section of the Indiana Toll Road. Mr. Johnson was formerly chief engineer for Greer and McClelland at Montclair, N.J.

Herbert Krakow, civil engineer with the Contract Administration of the City of New York, has been designated division engineer in charge of heavy construction. In recent months, Mr. Krakow has been in charge of construction of public improvements in the United Nations area.

Morton O. Withey, emeritus dean of the University of Wisconsin College of Engineering, and **Bernard A. Etcheverry,** consulting engineer and professor of irrigation and drainage at the University of California, were elected to the grade of National Honor Member in Chi Epsilon, honorary engineering fraternity, at the recent Cornell Conclave. **Harold T. Larsen,** manager of ASCE Technical Publications, was presented with an onyx and gold fountain-pen and ink stand, honoring him as "Councillor Emeritus in appreciation of his service and devotion to Chi Epsilon. . . ."

Robert L. Lowry, consulting hydraulic and civil engineer, of Austin, Tex., announces the removal of his office to 307 West 12th St., in that city.



Thomas C. Kavanagh (right) professor and chairman of the department of civil engineering, New York University, and member of Praeger-Kavanagh, Engineers, New York, receives the Architectural League's 1954 Gold Medal in Engineering for outstanding creative design work from League President Daniel Schwartzman, at a dinner on March 18. The award, which was shared by Camilo Piccone, Mexican engineer, cites the design and erection of the Rio Blanco River Bridge near Vera Cruz (November 1953 issue, p. 85). The League's Silver Medal was awarded to the firm of Hardesty & Hanover, New York, and Honorable Mentions went to Arsham Amirikian, of Chevy Chase, Md.; and Parsons, Brinckerhoff, Hall & Macdonald, New York.

(*Continued on page 105*)

Wins Race With Time And Death

An Actual Job Report from IH

New Highway Ends Traffic Danger at Atomic Plant

PORTSMOUTH, OHIO: — Highway officials here today hailed Bill Ward and his crew of Construction Service, Inc., who completed a difficult subcontract, part of the relocation of U. S. Highway 23, in one-third the expected time. Ward's fast work speeded completion of the new four-lane expressway replacing an old narrow, twisting road which could not safely carry the increased traffic of the 40,000 new families expected when the new Atomic Energy Plant is completed near here.

Ward's contract covered cutting more than 312,000 cubic yards of earth and rock off steep Four Mile Hill and filling approaches to an overpass a mile away. It was expected to take six months, but today...

WARD GETS THE TOUGH JOB. AND, SOON, AT THE ROCKY, RUGGED 520-FOOT PEAK--

HOW DO YOU PLAN TO HANDLE ROCK THIS BIG WITHOUT BLASTING? ONLY A MOUNTAIN-GOAT COULD GET AROUND UP HERE!

--OR A GOOD CRAWLER. LOOK -- I'M COUNTING ON INTERNATIONAL TD-24S TO LICK THIS PART OF THE JOB.

SEE -- THAT CRAWLER IS CHEWING OUT ROCK AS BIG AS ITSELF!

INSIDE A WEEK, HANGING ONTO THE STEEP SLOPE, THE BIG TD-24 CRAWLERS CUT DOWN TO THE 400-FOOT LEVEL, MAINTAINING 1½ TO 1 GRADE. THEN THEY HACK OUT A BENCH SO THAT THE INTERNATIONAL SCRAPERS CAN BE BROUGHT IN.

THERE'S YOUR IDEA AT WORK, BOSS -- PUSHLOADING AT 400 FEET WITH TD-24S AND SCRAPERS.

THOSE BIG RIGS CAN SURE TAKE PUNISHMENT!

AT 300 FEET, THE GRADE LESSENS. PHASE 3 BEGINS. NOW, INTERNATIONAL TWO-WHEELED, RUBBER-TIRED TRACTORS AND SCRAPERS TAKE OVER, AND THE CUTTING AND CARRYING REALLY SPEEDS UP...

WE'RE REALLY ROLLING, BOSS... AND THOSE INTERNATIONALS ARE GAINING A LOAD AN HOUR ON OUR OTHER RIGS!

GREAT, ED. IT LOOKS AS THOUGH WE'RE IN -- BUT KEEP PUSHING!

IT'S A MILE HAUL FROM THE CUT TO THE FILL FOR THE OVERPASS -- DOWN-HILL LOADED AND UPHILL BACK -- AND A RAILROAD CROSSING EACH WAY!

COPYRIGHT 1954, PICTORIAL MEDIA, INC.


UNEXPECTEDLY, TRAFFIC ON THE RAILROAD DOUBLES... JUST AS THE FAST INTERNATIONAL RUBBER-TIRED RIGS START THE OVERPASS-FILL ON THE OTHER SIDE OF THE TRACKS!
LOOK AT THAT... THE 18TH LONG COAL TRAIN TODAY! AND, YESTERDAY, THEY COST US 2½ HOURS--
I DIDN'T FIGURE THIS IN MY BID. BUT THOSE INTERNATIONALS HAVE PUT US WAY AHEAD.
C'MON, C'MON... LET'S GO!
WE'RE THE ONLY OUTFIT WORKING TODAY. RAIN CAN'T STOP THIS CREW!
ONE MIDNIGHT, AS THE JOB GOES INTO THE 'HOME-STRETCH'...
GOT TROUBLE, SHORTY?
NO TROUBLE, BOSS, JUST REGULAR GREASIN'. STILL NO DOWNTIME ON THIS JOB!
AND THEN THE WARD OUTFIT SETS ANOTHER RECORD, IN SPITE OF THE TRAINS... 8,400 CUBIC YARDS MOVED IN 9 HOURS ON AN 8,000-FOOT CYCLE, USING 7 HAUL UNITS! TWO MONTHS FROM THE STARTING DATE, THE JOB IS FINISHED, AND...
HALF THE FIGURED TIME, MR. WARD! ON THIS JOB, WHEN YOU SAVED DAYS, YOU SAVED LIVES, TOO!
IT WAS PART LUCK, ALL RIGHT... BUT I GIVE THAT CREW OF MINE GOOD EQUIPMENT, AND THEY MAKE THEIR OWN BREAKS!

Head in the clouds, feet on the ground

BILL WARD, owner of the Construction Service, Inc., Ludlow, Kentucky, is a man with his head in the clouds... but only when he's making an aerial survey of a prospective job in his four-place Navion plane. The rest of the time his feet are very firmly planted on the ground, when it comes to getting things done in the contracting business.

Starting as a shovel runner in New England for B. Perini & Sons, Inc., Framingham, Mass., Bill worked up to superintendent. In 1945 he realized an 18 year ambition by going into business for himself with a single power shovel. On the Four Mile Hill subcontract he used 20 big pieces of earth-moving equipment, including six INTERNATIONAL crawlers with matched INTERNATIONAL dozers, two INTERNATIONAL B-170 scrapers, and three INTERNATIONAL two-wheeled, rubber-tired tractors and scrapers.

He's proudest of the fact that he won the 1952 Safety Award given by the West Virginia chapter of the A.G.C. Association in the 10-20,000 man hours per year class for not having a single lost time accident. In 1953 he again finished out the year with a similar safety record. That's a real tribute to Ward, his men, and his big red INTERNATIONAL Power!

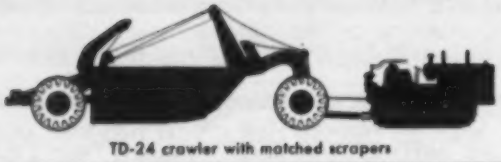
INTERNATIONAL HARVESTER COMPANY, CHICAGO 1, ILLINOIS

INTERNATIONAL

POWER THAT PAYS

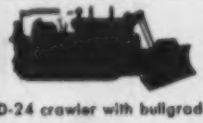
Now All in One Family

The hardest-working work teams in the world!



TD-24 crawler with matched scrapers

TD-18A crawler with matched scrapers



TD-24 crawler with bullgrader

T-9 and TD-9 crawler with hydraulic bulldozer

T-6 and TD-6 crawler with hydraulic bulldozer

TD-14A crawler with cable bullgrader

TD-9 tractor with front-end loader

TD-18A crawler with sideboom

Model 2T-75 two-wheel, rubber-tired tractor with 18 heaped-yard capacity scraper

Model 2T-75 two-wheel, rubber-tired tractor with 20 heaped-yard capacity bottom dump wagon

Model 2T-55 two-wheel, rubber-tired tractor with 13 heaped-yard capacity scraper

CR-610-D 2/28

LITHOGRAPHED IN UNITED STATES OF AMERICA

News of Engineers

(*Continued from page 100*)

Ralph B. Wiley, head of the School of Civil Engineering and Engineering Mechanics at Purdue University since 1937, and director of the Joint Highway Research Project since 1939, is retiring on June 30

K. B. Woods

R. B. Wiley

after 46 years on the faculty. He will be succeeded by **Kenneth B. Woods,** professor of highway engineering and associate director of the Joint Highway Research Project. **Harold L. Michael,** research assistant in the Joint Highway Research Project and instructor in highway engineering, will be moved up to the assistant directorship of the highway project succeeding Professor Woods. Professor Wiley has served ASCE as Director and Vice-President and as president of the Indiana Section. Professor Woods is also active in Society affairs, and was president of the Indiana Section in 1948. A special meeting of the Indiana Section to honor Professor Wiley will be held jointly with the Student Chapters of Rose Polytechnic, Notre Dame and Purdue, on April 29 in the Purdue Union Club. Then an announcement will be made of the R. B. Wiley Memorial Engineering Library project, and a portrait painting of Professor Wiley, to be hung in the structure, is to be unveiled. Chairman of the ambitious library project is **Joseph L. Quinn.**

Edward K. Bryant, principal associate of Knappen-Tippetts-Abbett-McCarthy, New York, N.Y., has been appointed chief of the Technical Advisory Group to the Economic and Social Board serving the Government of Burma. An associate of the engineering firm since 1946, Mr. Bryant will reside in Rangoon, location of the Burmese headquarters of Knappen-Tippetts-Abbett-McCarthy.

Sheldon J. Leavitt, architect and engineer recently practicing in Chicago, Ill., has joined the firm of Leavitt Associates, architects and engineers, of Norfolk, Va.

Paul S. Calkins, Peter Mortenson, Jr., and **Alfred C. Emmerling,** of Detroit, Mich., have combined their professional practices to form Emmerling, Calkins & Mortenson, Inc., architects and engineers, with headquarters at 112 Madison Ave., Detroit. Prior to the merger, Mr. Calkins and Mr. Emmerling were engaged in private practice, and Mr. Mortenson was a member of the firm, Boddy-Benjamin, Associates.

Harry L. Clarke, associate civil engineer, canal and flood control, in the New York State Department of Public Works, Albany, retired on January 21 after 48 years of service with the state.

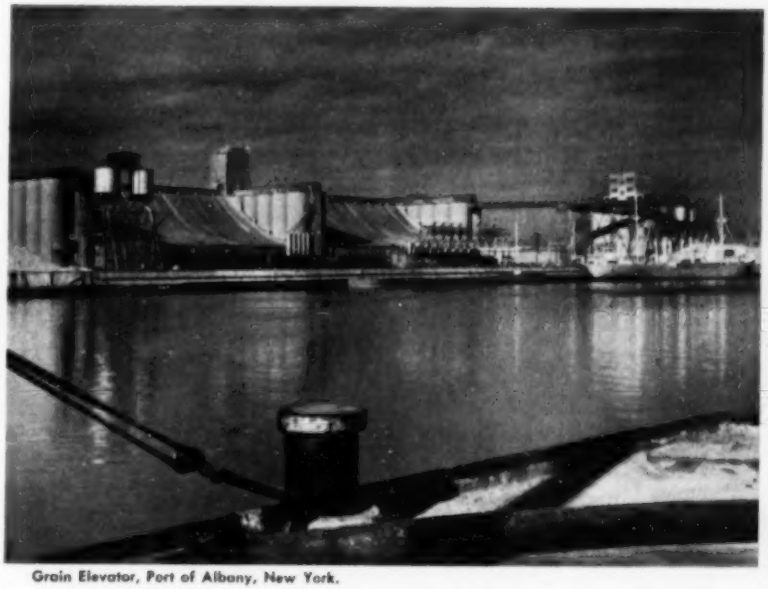
(*Continued on page 106*)

Our face is red!

EPPINGER & RUSSELL CO.

-not KOPPERS

Supplied the 7,400 foundation piles for this grain elevator



Grain Elevator, Port of Albany, New York.

SINCERE apologies to Eppinger & Russell Company for a regretable mistake in our February advertisement in which we stated that these were Koppers Pressure-Creosoted Piles. Information on which we based this statement was found later to be incorrect.

However, our ad was correct about pressure-creosoted foundation piles being used on many such building projects because they are strong, permanent and cost less than other pile materials. Thoroughly pressure-treated with creosote, these piles retain their strength . . . resist attack from decay and termites.

Approved by the A.S.A. Building Code, pressure-creosoted foundation piles are classified as permanent construction when cut off above the water table, and tops saturated with creosote and capped in concrete.

KOPPERS COMPANY, INC.
PITTSBURGH 19, PENNSYLVANIA

For cost-conscious contractors!

Sonotube®

FIBRE FORMS

for round columns of concrete

Round columns formed with Sonotube. Cincinnati Public Library. Frank Messer & Sons, Contractor

SONOTUBE Fibre Forms save time, labor and money!

These low cost forms take fewer men to handle because they are lightweight . . . take less time to erect because they require minimum bracing.

Widely used and approved by contractors, engineers and architects everywhere, SONOTUBE is proven to be a fast, *economical method of forming round columns of concrete* for a multiplicity of structures.

For one time use, SONOTUBE forms can be supplied in specified lengths or sawed to your requirements on the job. In 31 sizes, from 1" to 36" I.D. up to 50' long.

DENFORM, reusable capital form, designed for use with Sonotubes.

For complete technical data and prices—write

SONOCO PRODUCTS COMPANY
Construction Products Division
LOS ANGELES, CAL. — HARTSVILLE, S. C. — MAIN PLANT — MONTCLAIR, N. J.
GARWOOD, N. J. — BRANTFORD, ONT. — AKRON, OHIO

sonoco
"ROUND THE WORLD"
PAPER CARRIERS
REG. U.S. PAT. OFF.

News of Engineers

(*Continued from page 105*)

Key figures in a recent conference conducted by the West Virginia State Road Commission in cooperation with the Universal Concrete Pipe Co., and Armco Drainage and Metal Products Co., are (left to right) H. K. Griffith, A.M. ASCE, commissioner, West Virginia State Road Commission; Thomas H. Monaghan, vice-president, Universal Concrete Pipe Co.; and Arthur K. Banks, A.M. ASCE, assistant to the commissioner.

Michael Bar-Shany has returned to Israel after a four-year stay in the United States, and is now project engineer for the Water Planning for Israel Co.

Lawrence E. Hall recently joined the staff of the Washington State Power Commission, Seattle, Wash., as planning engineer. For the past seven years he has been with the Seattle District of the Corps of Engineers.

Raymond F. Hall, Jr., Albert W. Daniels and **Curtis M. Brown** announce the formation of a partnership, Daniels, Brown and Hall, for the general practice of civil engineering and land surveying, with offices at 2375 San Diego Ave., San Diego, Calif. Both Mr. Hall and Mr. Daniels had been in private practice in San Diego for several years.

Frank H. Gardner has been appointed district engineer for the Asphalt Institute, New York, N.Y., and will cover New York State exclusive of New York City and Long Island. For the past three years he has been with the Military Air Transport Service, U.S. Air Force, as chief paving engineer.

Frederick W. Crane has returned to the Buffalo Sewer Authority as general manager after serving for the past four years as Buffalo Commissioner of Public Works.

Daniel V. Terrell and **Richard E. Dougherty** have been appointed by Governor Goodwin J. Knight to advise him in his capacity as chairman of the California Toll Bridge Authority, and as consultants to the California Department of Public Works on the construction of a 38,000-ft tube-and-trestle crossing of San Francisco Bay. Engineering studies on the bent southern crossing between Army Street, San Francisco, and Bay Farm Island, Alameda, estimated to cost $250,000,000, are being directed by **Norman C. Raab.**

W. Bion Moore, chief of the Economic & Resources Division of the Project Planning Branch, U. S. Bureau of Reclamation, Amarillo, Tex., and **Oliver C. Reedy,** chief of the Programs & Reports Branch, Project Planning Division, Billings, Mont., are now on a 90-day assignment with the Foreign Operations Administration. They are acting as advisers to Philippine officials on the Marikina River project near Manila.

Paul S. Bailey has retired as bridge engineer for the Colorado State Highway Department at Denver after 31 years of service.

Warren E. Racine has joined the engineering staff of the Timber Engineering Co., Washington, D.C., and after a brief indoctrination period, will assume managerial duties in the company's Chicago office. A 1951 graduate of the University of Wisconsin, Mr. Racine has been with the du Pont Company and Ammann & Whitney.

Maurice R. Scharff, New York consultant specializing in public utilities and public and private power enterprises, has been appointed by the Foreign Operations Administration to head a seven-man team of United States engineering specialists, who will aid in evaluating the major industrial projects in Western Europe and Africa that have been developed with some financial assistance from the United States. Among those named to the team are **Burnside R. Value,** consulting engineer and partner in the firm of Seelye, Stevenson, Value and Knecht of New York, who will inspect highway, air transport, waterway and harbor projects, and **William Ginsberg,** consulting engineer of New York, who will inspect manufacturing plants.

Frank Kerekes, assistant dean of engineering at Iowa State College, is the recipient of the Anson Marston Award "for pre-eminent contribution to the work of the Iowa Engineering Society in the areas of technical and professional development of its members." Announcement of the award was made at the banquet session of the Iowa Engineering Society's 64th annual meeting in March.

William J. Dennis was recently advanced from associate soils engineer to assistant district engineer for District 6 of the New York State Department of Public Works, with headquarters at Hornell, N.Y. Mr. Dennis has been with the department since 1926.

Floyd D. Vermilya, executive engineer for Sanderson & Porter, New York, N.Y., was recently admitted to partnership in the firm.

Herbert D. Vogel, chief of the Southwestern Division of the Corps of Engineers, at Dallas, Tex., has been promoted from the rank of colonel to brigadier general.

William W. Wanamaker, brigadier general (retired), who served as executive director of the New Jersey Turnpike Authority from December 1949 to December 1951, returned to the Authority on April 12 and has resumed his former post. For the past

(*Continued on page 108*)

Eliminate costly dead weight!

Form prepared for precasting.

for voids in concrete construction

Bridge member, precast by Concrete Products Company of America, being lifted into place.

Eliminate the costly dead weight of concrete without impairing structural strength.

Low cost SONOVOID Fibre Tubes save concrete and reinforcing steel . . . they form voids which displace the low working concrete at the neutral axis.

Specifically developed to reduce weight and lower cost of concrete bridge deck, wall, floor and roof slabs, SONOVOID also permits the prefabrication of prestressed and post-stressed units.

Supplied in specified lengths or sawed to your requirements on the job. Sizes: 2″ to 36.9″ O.D. up to 50′ long.

sonoco — SERVES THE WORLD — PAPER CARRIERS — REG. U.S. PAT. OFF.

For complete technical data and prices—write

SONOCO PRODUCTS COMPANY
Construction Products Division
LOS ANGELES, CAL. — HARTSVILLE, S. C. — MAIN PLANT — MONTCLAIR, N. J.
GARWOOD, N. J. — BRANTFORD, ONT. — AKRON, IND.

DAM REBUILT WITH "GUNITE"

This is Lower Doughty Pond Dam belonging to the Atlantic City, New Jersey, Water Department, a poured concrete structure with fresh water upstream and tide water at the downstream toe. This structure became seriously disintegrated and eroded as shown in the upper photo, and was completely restored with "GUNITE" a minimum of six inches in thickness with double mesh reinforcement.

The lower view shows the finished job completed by us in 1941. Both the upstream and downstream faces were restored with "GUNITE", as well as the wing walls.

Our 72-page general bulletin B-2400 describes this and scores of other uses of "GUNITE". We shall be glad to send it to you upon request.

CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES – ALLENTOWN, PA., U. S. A.

MANUFACTURERS OF THE CEMENT GUN

...You need CONSTRUCTION COST CONTROL

Written by construction men, and containing sections on: Classification of Construction Cost Accounts; Distribution of Costs; Control of Costs; Financing the Construction, and Taxes.

CONSTRUCTION COST CONTROL IS a practical answer to your cost problem.

Well illustrated and supported by charts and specimen accounting forms, this authoritative 97-page, 8½ x 11, sturdily bound book covers the complete cycle of estimating, accounting, distributing and analyzing of all operational and overhead costs. A practical and easily applied system is fully outlined.

Included are sections on: PRELIMINARY ESTIMATING, BUDGETING, CLASSIFICATION OF CONSTRUCTION COST ACCOUNTS, DISTRIBUTION OF ACCOUNTS, CONTROL OF COSTS, TIME AND MOTION STUDIES, FINANCING AND TAX PROBLEMS.

Sent postpaid to ASCE Members—$4.00 To non-members—$5.00
To ASCE Student Chapters in quantities of 10 or more—$3.00 each
To colleges for textbook use in quantities of 10 or more—$3.00 each

American Society of Civil Engineers
33 West 39th St., New York 18, N. Y.

Please send....copies of CONSTRUCTION COST CONTROL.

Enclosed is check (or money order) in the amount of $....
(I am).....(I am not).....a member of ASCE.

Name.....

Firm.....

Street.....

City.....State.....

News of Engineers

(*Continued from page 107*)

two and one-half years, General Wanamaker has been chief engineer of the Orinoco Mining Co., in charge of engineering the development of U. S. Steel's ore reserves in Venezuela.

Rex M. Whitton was one of five recipients of the Missouri Honor Awards for Distinguished Service in Engineering, presented at a special convocation climaxing Engineers' Week at the University of Missouri. An alumnus of the university, Mr. Whitton was presented with a bronze medal and cited for his thirty-four-year career with the Missouri Highway Department, culminating in the position as chief engineer.

Walter L. Huber, Past-President of ASCE, has been selected by President Eisenhower to be Presidential Adviser for the Arkansas, White and Red River Basins Survey, a type of assignment without precedent in federal water resources planning. Mr. Huber's duties will include assistance to the Federal Interagency Committee now in charge of completing an integrated and possibly final report on the Arkansas, White and Red River Basins.

Thomas H. MacDonald, Honorary Member of ASCE and former U. S. Commissioner of Public Roads, has been honored for his contributions to the field of transportation by Syracuse University, which has named him Salzberg Lecturer for 1954. Mr. MacDonald delivered an address entitled, "The Engineer's Relation to Highway Transportation," on April 28, during a two-day program on transportation.

George Grove, formerly associated with Headman, Ferguson & Carollo at Tucson, Ariz., is now director of public works for the City of Tucson. Mr. Grove has had previous experience as engineer for Pima County and city engineer of Tucson.

C. George Dandrow, vice-president of Johns-Manville, New York, N.Y., was re-elected president of the New York Building Congress at its 33rd annual meeting on April 1. Another Society member elected is **Max Abramovitz,** Harrison & Abramovitz, who will serve as vice-president.

George F. Dixon, lieutenant colonel, Corps of Engineers, Vicksburg, Miss., has resigned from the Army and is now vice-president in charge of engineering for the Carlisle Corp., Carlisle, Pa.

Nicholas Feodoroff, professor of hydraulics at Manhattan College, was recently awarded the Medal of French Renaissance for scientific achievement in a ceremony at the French Embassy in New York City.

G. A. Fleet has opened an office as manufacturers' representative with headquarters at 175 Orawaupum Street, White Plains, N.Y. He will specialize in the handling of sanitary engineering equipment for a number of companies. Mr. Fleet was formerly New York district manager for the American Well Works.

ON THE JOB for Bryant & Detweiler, Detroit. Fennel Instruments are American type, with erect image, 4 levelling screws, etc.

SURVEYING EXPERTS favor FENNEL INSTRUMENTS

HERE'S ACCURACY to satisfy the most critical—carefully built-in by old-world craftsmen with generations of skill.

6¼" TRANSIT. Ideal for road-building, railroads, public works.

"NITAC" LEVEL. World's only level with split bubble, erect image.

"THEMI" THEODOLITE. "Superior workmanship", says U. S. Army Ordnance expert.

UNIVERSAL WYE LEVEL. Internal focusing telescope with 32x magnifying power.

Try Fennel Instruments, and we're sure you'll want to buy them. So easy to use. So accurate! Contact your nearest dealer for particulars and prices.
REPAIR SERVICE by Factory-Trained personnel. Dependable, thrifty!

FENNEL INSTRUMENT CORP. OF AMERICA • 478 Water Street, New York 2, N. Y.

CONTACT THESE DEALERS:

Boise:.....Boise Blueprint Co., 1009 Idaho St.
Boston:..Modern Blueprint Co., 51 Cornhill St.
Buffalo:....Wilder Photo Copy, 23 E. Huron St.
Charlotte: Southerland Blueprt., 119 W. 1st St.
Charleston, W. Va.: L. H. Hill, 1002 Quarrier St.
Chicago:....Crofoot Nielsen, 205 Wacker Dr.
Columbia, S. C.: Capital Blueprint, 908 Main St.
Detroit:..Ostermann Co., 2222 Woodward Ave.
Houston: Stanley Blueprint, 1112 McKinney St.
Jackson, Miss.: Neely Blueprt., 220 W. Pearl St.
Lexington: A & E Supply, 601 S. Limestone St.
Lincoln, Neb.:.....Pat Ash, Inc., 1211 P. St.
Long Beach, Cal.: Krieg & Piazzi, 5303 Vil. Rd.
Memphis: Wray Williams Co., 23 S. Second St.
Mobile: Bidgood Stationery, 67 St. Francis St.
New Orleans:.....Copelands, 826 Gravier St.
Oklahoma City:.....Universal Blueprint Co. 130 N. W. 2nd St.
Philadelphia: Phila. Blueprt., 725 Chestnut St.
Phoenix:...Scotts Technical, 333 N. Third Ave.
Pittsburgh:..American Blueprt., 110 Sixth St.
Portland, Ore.: J. K. Gill, S.W. 5th Ave. & Stark
Richmond:..W. F. Hobart, 805 E. Franklin St.
Savannah:..Andrew Bunn Co., 140 Abercorn St.
St. Louis: Commercial Blueprt., 1123 Locust St.
Springfield, Mo.: Springfield Blueprint & Photo 417 South Robberson
Toledo:.....L. Beckmann Co., 1609 Canton St.
Topeka: Capital City Blueprt., 421 Kansas Ave.
Trenton:.....D & W Blueprint, 16 Perry St.
Washington: F. C. Montuori, 2013 K. St., N.W.

Atlantic City Convention of ASCE

Haddon Hall Hotel, Atlantic City, N.J., June 15–18, 1954

MAIL TO: Mr. Ralph Earle, Chairman, Hotel Arrangements
Haddon Hall Hotel, Atlantic City, New Jersey

Please reserve the following accommodations on the European Plan .... or American Plan ....
For American Plan (meals) add $7 per day per person

No. of Rooms	Rooms with Bath		Haddon Hall (Convention Hdqtrs.)			Chalfonte Hotel (Across Street)		
.....	Single	For one person	$ 7	$ 8	$10	$ 6	$ 7	$ 9 ....
.....	Double (twin beds), without ocean view	For two persons	$10	$12	$13	$ 9		$11 ....
.....	Double (twin beds), side ocean view	For two persons	$15	$17	$19	$13		$15 ....
.....	Double (twin beds), ocean front	For two persons	$20		$22	$15	$17	$19 ....
.....	Parlor, ocean front		$22					
.....	Parlor, side ocean view		$19		$17			

For each additional person in double room, add $3 European Plan or $10 American Plan. Deduct $2 from double rate for single occupancy of any double room.

I will share a room with.....

Expect to arrive.....Depart.....

Name.....

Address.....

This reservation will be acknowledged. Please arrange to double up when possible, as single rooms are limited. Are you willing to share a room with another ASCE member? .....

Atlantic City Convention of ASCE

Mr. HARRY J. ENGEL
Registration Chairman
c/o Haddon Hall Hotel
Atlantic City, N.J.

Yes, it is my plan to attend the Atlantic City Convention, with .... guests. Please reserve for my use the following tickets, which I shall pick up when I arrive and register:

Function	No. of Tickets
Tuesday, June 15	
Ladies' Luncheon and Bridge	.....
Wednesday, June 16	
Governor's Luncheon	.....
Convention Dinner	.....
Thursday, June 17	
Ladies' All-Day Boat Ride	.....
Inspection Trip	.....
Clambake	.....

ENGINEERING SOCIETIES

PERSONNEL SERVICE, INC.

NEW YORK	CHICAGO	DETROIT	SAN FRANCISCO
8 W. 40th ST.	84 E. RANDOLPH ST.	100 FARNSWORTH AVE.	57 POST ST.

This placement service is available to members of the Four Founder Societies. If placed as a result of these listings, the applicant agrees to pay a fee at rates listed by the service. These rates—established to maintain an efficient nonprofit personnel service—are available upon request. The same rule for payment of fees applies to registrants who advertise in these columns. All applications should be addressed to the key numbers indicated and mailed to the New York Office. Please enclose six cents in postage to cover cost of mailing and return of application. A weekly bulletin of engineering positions open is available to members of the cooperating societies at a subscription rate of $3.50 per quarter or $12 per annum, payable in advance.

Men Available

CIVIL ENGINEER; A. M. ASCE; 32; BSCE '43; experienced in design, estimates, specifications, construction supervision of airfields, bridges, buildings, railroads, roads, surveys, investigations, reports, and negotiations. Prefers active, demanding and responsible work, with or without travel, foreign or domestic. C-951.

PROFESSOR; structural, hydraulic, fluid mechanics; M. ASCE; Ph. D.; four honorary societies; 25 years' teaching and practicing experience; now teaching. Desires relocation and some graduate courses. C-952.

HYDRAULIC ENGINEER; J. M. ASCE; 28; married; BSCE; 3 years' responsible experience in field and office as irrigation and drainage engineer in northwest. In charge of feasibility studies, design, layout, specifications, supervision of installations of irrigation and drainage works. Desires permanent position with advancement opportunities. C-953.

CIVIL ENGINEER; A. M. ASCE; 43; registered professional engineer, Wisconsin. Twenty-three years' progressive experience in layout, design, construction, maintenance and management; foreign and domestic. Available 30 days after acceptance of offer. C-954.

CIVIL ENGINEER; J. M. ASCE; 27; married; BSCE Purdue '50; experience in design and maintenance in pulp and paper industry; knowledge of job estimating, has done field work in connection with design. Desires work as field engineer on construction work. Location preferred, Northwest. C-955.

PUBLIC UTILITY ENGINEER; A. M. ASCE; 40; married; 9 years' experience water, hydro, gas, sewerage. Supervision $3 million Newfoundland project including staff training, rate structures, construction, design, purchasing; contract expires June. Desires position public utility engineer or staff consultant anywhere. C-956.

CIVIL ENGINEER; J. M. ASCE; 24; married; 3 years' responsible experience in administration of operation, maintenance engineering plants as Navy staff engineering officer; highway, earth-filled dam construction, field surveying experience. Desires permanent position with harbor or port authority, contracting firm, city, county highway commission or company. Location preferred, West Coast or New Mexico. C-957-543-A-5-San Francisco.

CIVIL ENGINEER; M. ASCE; 40; married; California and National Board Registration; 9 years' operating own practice, structural frameworks, complete design of civil, structural and architectural features large military bases; administrative experience in contracting, heavy and institutional; design experience, bridges, piers, railroads, roads. Seeks partnership or principalship with large or growing firm in need of executive engineering help; willing to invest. C-958-542-A-3-San Francisco.

CONSULTANT; M. ASCE; 67; married; registered professional engineer in Oregon. BS (Min. Eng.) and CE 45 years' varied civil and agricultural engineering experience in irrigation and drainage, including 6 years' teaching and 4 years' foreign project investigation and design. Reads Spanish and French. Available now for short assignments. Location preferred, West. C-959-543-A-2-San Francisco.

FIRE PROTECTION ENGINEER; A. M. ASCE; 53; married; A. M. Society of Fire Protection Engineers, N. F. P. A.; 20 years' diversified responsible experience. Structural and mechanical engineer on large power refinery and industrial plants. Municipal engineer for two towns in Pennsylvania. Presently employed West coast. C-960-532-A-4-San Francisco.

CIVIL ENGINEER; A. M. ASCE; graduate CE; 36; married; registered professional engineer; extensive hydroelectric design, feasibility, cost, structure layout, hydrological and power output studies. Contractor, client relationships, coordination field and office forces, general experience in several other types of projects. Location preferred, South, West and Northwest. C-961.

HYDRAULIC ENGINEER; M. ASCE; 40; married; CE, MSCE; registered civil engineer, California. Outstanding experience in hydraulics and construction engineering; 8 years in key supervisory positions. Design, planning, estimates, reports for water resources developments; hydraulics laboratory military construction, Korea. Desires responsible supervisory position; will consider teaching. Location preferred, West coast. C-962-539-A-2-San Francisco.

CIVIL, HYDRAULIC, FIRE PROTECTION ENGINEER, M. ASCE; 63; married; CE degree Cornell; registered professional engineer; M. AWWA; 32 years with NBFU as hydraulic engineer on surveys and reports on water works and fire protection about 200 larger cities. Additional hydraulic and consulting experience. Desires position with water department, private utility or consulting firm. C-963-855-Chicago.

Positions Available

STRUCTURAL ENGINEER, about 40, professional civil engineer's license in New York State; must have experience in structural steel fabrication and erection. Salary, $9,000–$10,000 a year. Location, New York State. Y-9644.

CITY ENGINEER, capable of assuming all the duties and responsibilities of municipal engineering. Location Texas. Y-9762.

MUNICIPAL ENGINEER, young, with a few years' experience in municipal work. Will work on a wide variety of projects, including engineering design, improvement of operating methods, etc. Location, New Jersey. Y-9773.

MINING OR CIVIL ENGINEER, 30-35, with strip and underground mine experience, to make surveys, plan production improvements, etc., under direction of chief engineer. Considerable traveling to properties in West and South. Salary, $8,400–$9,600 a year. Headquarters, Illinois. Y-9782.

CITY PLANNER, graduate degree in planning, preferably with undergraduate training in engineering and some general planning experience; comparable training and experience acceptable. Location, Pennsylvania. Y-9825.

CHIEF DRAFTSMAN, engineering graduate, with 15 to 20 years' design and detailing experience, primarily steel and concrete bridges, for small established consultant's office. Location, Missouri. Y-9840.

SALES ENGINEER, 24–30, engineering degree desirable; previous sales experience unnecessary. Established national concern selling prefabricated metal products to engineering and construction markets. Complete training program; car furnished; salary and bonus. Territory open, Rochester, N. Y. and Pittsburgh, Pa. Headquarters, Pittsburgh, Pa. Y-9846.

Designers

Work on the engineering and design of steel and reinforced concrete structures for oil-refineries and chemical plants.

C F BRAUN & CO

Engineers • Constructors

1000 SOUTH FREMONT

ALHAMBRA

CALIFORNIA

DESIGN ENGINEER, Age 25-45.

Civil Engineer graduate or equivalent with minimum of 3 years experience. Must be eligible for Nebraska Professional engineer registration, be proficient in design of concrete hydraulic structures and have understanding of City pavement, sanitary and storm water sewer design. Salary in accordance with qualifications and experience. Position available immediately.

RAY RAMSAY

Personnel Director

City of Lincoln, Nebraska

AIRCRAFT ENGINEERS

With Experience

WANTED AT

GRUMMAN

LAYOUT DESIGNERS
Airframe Structures
Equipment Installations

FLIGHT TESTING
Planners
Analysts

HYDRAULICS
Systems Design
Testing

STRUCTURES
Stress Analysis
Static Testing

RESEARCH
Computer Engrs.—IBM & REAC
Vibration & Flutter Engrs.
Dynamic Analysis—Systems Engineers

ARMAMENT INSTALLATION
AERODYNAMICS
INSTRUMENTATION

TOOL ENGINEERS
FORM DIE DESIGNERS

Recent Graduates with Aeronautical, Mechanical, Civil or Engineering Physics Degrees may qualify.

Proof of U. S. Citizenship Required

APPLY IN PERSON
OR SEND RÉSUMÉ TO:
Engineering Personnel Dept.
INTERVIEWS AT
Employment Office
South Oyster Bay Road,
North of Railroad
Monday thru Friday
8:30–11:30 AM; 1:30–3:30 PM

GRUMMAN AIRCRAFT
Engineering Corp.
Bethpage, N. Y.

DESIGN ENGINEER. Head of dam designs, well experienced in the design of the dam on the civil side, and preferably an expert in foundation problems. Should be a graduate, with at least 10 years' experience in connection with design of high dams. Will conceive and execute plans and be responsible for adequacy of designs; plan and schedule work; supervise preparations and review of specifications, etc. Salary, $11,700 a year, free of tax; transportation for self and family. Two-year contract. Location, India. F-9857.

INSTRUCTOR with BS or MS in civil engineering to teach plane surveying, and mechanics of materials. Opportunity for graduate study. Salary, $3,700–$4,000 for nine months. Location, Southwest. Y-9859.

CONSTRUCTION SUPERINTENDENT with at least 10 years' institutional, commercial and industrial building experience, to take charge of jobs for local contractor. Salary, $9,100 a year. Location, northern New Jersey. Y-9863.

RESIDENT ENGINEER, civil graduate, with experience in the supervision of rock tunnel for either owner or contractor. Two or three years' work. Salary, $9,000–$9,600 a year. Location, southern New England. Y-9881.

BUILDING COMMISSIONER, graduate civil engineer or architect, 35 or over. With at least 10 years' experience. Will have charge of several building inspectors. Should be strong in structural engineering with an architectural background. Can use man who is retired and who has had previous building and structural experience. Salary, $6,000 a year. Location, northern Indiana. C-1755.

DISTRICT ENGINEERS, civil or architectural, not over 45. With at least 5 years' experience in theory and design of structural steel with fabricator, consultant or teaching. Some sales promotional and trade association experience. Should be combination of engineer qualified to design materials of construction with structural steel a must, sales and public relations man; must have good personality and able to present his subject well. Position is with trade association. Salary, $7,500 a year, plus traveling expenses. Location, Detroit or Chicago. C-1819.

Non-ASCE Meetings

American Institute of Chemical Engineers. Twenty-sixth national meeting at Springfield, Mass., May 16–19. Headquarters, Hotel Kimball.

American Society for Engineering Education. Sixty-second annual meeting at the University of Illinois, June 14–18.

American Society for Testing Materials. Fifty-seventh annual meeting and exhibit at the Sherman Hotel, Chicago, Ill., June 13–18.

American Society of Photogrammetry. Second annual meeting of the Metropolitan (New York) Section at the Green Engineering Camp, Ringwood, N.J., June 5, 9 a.m. to 5 p.m.

American Water Works Association. Seventy-fourth annual convention in the Seattle (Wash.) Municipal Auditorium, May 23–28.

Basic Materials Exposition. Basic Materials Exposition at the International Amphitheatre, Chicago, Ill., May 17–20.

Chi Epsilon. Meeting of the New York Alumni Chapter in the Engineering Societies Building, Room 1101, June 2, 7:30 p.m., preceded by an informal dinner (at

(*Continued on page 112*)

HIGHWAY DESIGN ENGINEER

Degree. Minimum 5 years responsible work on overall design and planning of highways.

MUNICIPAL ENGINEER

Degree. Minimum 5 years responsible work on overall design and planning of city streets.

SPECIFICATION WRITER

Degree. Responsible experience in writing specifications for heavy civil engineering work. Must have ability to correlate specifications for incidental architectural, mechanical and electrical phases of work into completed specifications.

ARCHITECTURAL DRAFTSMAN

Minimum 5 years experience. Preferably in industrial plant design.

Submit complete resumé. Salary requirements, references and date of availability with first letter. All replies to Box 231

Civil Engineering
33 West 39th Street
New York 18, N. Y.

Non-ASCE Meetings

(*Continued from page 111*)

6 p.m.) in the New York Times Dining Room, 11th floor, 229 West 43rd St.

National Society of Professional Engineers. Meeting at the Schroeder Hotel, Milwaukee, Wis., June 9–12.

Society of Automotive Engineers. Summer meeting at the Ambassador and Ritz-Carlton hotels, Atlantic City, N.J., June 6–11.

Society of Naval Architects and Marine Engineers. Spring meeting at the Olympic Hotel, Seattle, Wash., May 17–18.

UPADI. The third convention of the Pan American Federation of Engineering Societies (UPADI) will meet at Saõ Paulo, August 2–12. Write to EJC, 29 West 39th St., New York, N.Y., for more detailed information.

World Power Conference. Sectional meeting will be held in Rio de Janeiro, July 25–August 10. Detailed information is available through EJC, 29 West 39th St., New York, N.Y.

Inter-American Association of Sanitary Engineering. Fourth conference will be held in Saõ Paulo, Brazil, July 25–31. Details may be obtained from Engineers Joint Council, 29 West 39th St., New York 18, N.Y.

PLASTIMENT* CONCRETE DENSIFIER

CONTROLS SET AND REDUCES WATER CONTENT WITHOUT CHANGING AIR CONTENT FOR

- GREATER UNIFORMITY
- CRACK RESISTANCE
- WATER RESISTANCE
- SURFACE HARDNESS

*Plastiment consistently produces higher structural values in concrete because it limits and controls the growth of water-consuming cement gels during mixing and placing of concrete. This action reduces the water-cement ratio and retards the set of all concretes, plain or air-entrained, regardless of type of cement or aggregate. Uniformity of set and water content (the governing factors of uniform concrete quality) are made possible by changing Plastiment proportions with concrete-placing-temperatures and field conditions.

Controlled set and uniformly low water content—exclusive with Plastiment—means less segregation, shrinkage, cold joints and other defects, greater uniformity and resistance to abrasion, cracking and leakage.

Write for your copy of "Plastiment Concrete Densifier" booklet and the Sika Job Bulletin describing the job at right. ➔

11 APARTMENT HOUSES AT PARKMERCED, SAN FRANCISCO
REINFORCED CONCRETE WITH PLASTIMENT
For details on the above project, write for "SIKA JOB BULLETIN #8."

Sika SIKA CHEMICAL CORPORATION
PASSAIC, NEW JERSEY
BRANCH OFFICES: PITTSBURGH, SALT LAKE CITY, MONTREAL
CHICAGO, PANAMA • DEALERS IN PRINCIPAL CITIES

Experimental filters for acetate wastes . .

(This article begins on page 42)

(*Continued from page 45*)

sewage was continued for $2\frac{1}{2}$ months without any apparent benefit. After 5 months of operating with the concentrated chemical waste, the raw feed was diluted with cooling water. This dilution naturally reduced the B.O.D. of the applied waste. To compensate for the decrease in numerical value, the applied load was volumetrically increased to conform with the unit load applied previously. This resulted in changing the filter from a conventional low-rate to a high-rate filter. The change did not affect the efficiency. Within the scope of the recycles used it was indicated that the percentage removal of B.O.D. was a direct function of the load applied.

The filters were operated continuously for 65 days at an applied load of 2 lb B.O.D. per cu yd. The volumetric loading was 1.94 million gal per acre per day recycled at 5:1. The first stage removed 64 percent of the applied load. The net reduction effected was 84 percent.

When the recycle ratio was reduced to 3:1, the efficiency increased and consistent results were obtained with an overall efficiency of 93.0 percent. The first-stage effluent dropped to 174 ppm from an average of 1,170, and 85.2-percent reduction. The effluent from the second stage was 82 ppm, a 52.8-percent reduction.

In summarizing the data collected by operating filters Nos. 1 and 2, we concluded that: (1) no particular advantage was gained by using higher recirculation ratios: (2) the upper loading limit which nets an appreciable B.O.D. reduction is approximately 1.6 lb per cu yd; (3) the organic matter in the waste derived from hydrolyzed material is less easily oxidized than the organic matter in the non-hydrolyzed waste; (4) there is no direct correlation between the volatile acid and the B.O.D. reduction; and (5) no particular advantage was gained by using forced ventilation.

The preliminary results obtained from the operation of the two-stage filters indicated that sufficient data had been collected to serve as a basis for design and further investigation at pilot-plant level.

(This article is based on the paper by Mr. Roznoy presented at the Atlanta Convention, in the Sanitary Engineering Division's Symposium on Problems of Industrial Waste Treatment, before the session presided over by Robert E. Stiemke, M. ASCE, and Richard King, A.M. ASCE.)

New in Education

For the first time, a special summer program in soil technology will be given at the Massachusetts Institute of Technology, from June 15 through June 25. The program is under the direction of T. William Lambe, associate professor of soil mechanics. Tuition for the course is $160. Further information and application blanks for this special summer program may be obtained from the Summer Session Office, Room 7-103, MIT, Cambridge 39, Mass.

A three-day conference on thin concrete shells, sponsored jointly by the departments of civil engineering and architecture at the Massachusetts Institute of Technology, will be held on the campus, June 21, 22, and 23. Sessions devoted to architectural design, structural design, and construction techniques have been included on the program. Although there is no tuition fee, a small registration fee is required. Full details may be obtained from the Summer Session Office, Room 7-103, MIT, Cambridge 39, Mass.

The Delaware State Highway Department has recently completed a school for project and construction inspectors, which was intended to procure uniformity in use of materials and construction work on eleven projects in every section of the state. The school was held one day a week for a period of six weeks and was under the personal direction of John B. Carson, construction engineer.

Three hundred and eight scholarships are now available at 34 colleges and technical institutions under the Union Carbide Scholarship Program. These four-year scholarships cover the cost of tuition, fees, allowances for books and supplies, and provide an annual grant-in-aid of $600 for the college during the life of the scholarship. Further information about the scholarships, which are open to all students of secondary and preparatory schools in the United States, may be obtained by writing to the Union Carbide Educational Fund, 30 East 42nd St., New York 17, N.Y.

The teaching of humanities and social sciences in the nation's colleges of engineering and science will be studied by authorities in engineering education, under terms of a $30,000 grant from the Carnegie Corp., of New York. The investigation, which is scheduled for completion by June 1955, will be directed by Dr. George A. Gullette, head of social sciences at North Carolina State College.

Establishment of two engineering scholarships, with grants totaling $18,000, is announced by Holmes & Narver, Inc., Los Angeles engineering firm. The scholarships provide a grant of $10,000 for four years at the Massachusetts Institute of Technology and $8,000 for similar study at Stanford University. Applicants must be male residents of southern California, in financial need, and students in civil, mechanical, electrical, chemical, or industrial engineering.

Three Pennsylvania colleges—Carnegie Institute of Technology, Lehigh University, and the University of Pittsburgh—will share in an annual $12,000 scholarship program established by the Dravo Corp. The program provides for two upper-division scholarships of $1,500 for each of the three schools. The scholarships at Carnegie and Lehigh will be in engineering, that at the University of Pittsburgh in business administration. The Scholarship Committee is headed by Alex W. Dann, executive vice-president of the Dravo Corp.

A short course on High Temperature Properties of Materials will be held at Pennsylvania State University, June 21 to 25, inclusive. It will be followed by a course on Mechanics of Creep, June 28 to July 2. The programs will include physical, metallurgical, and design aspects of the subjects, with lectures by authorities in industry, government, and education. Further information may be obtained from Dr. Joseph Marin, Department of Engineering Mechanics, Pennsylvania State University, State College, Pa.

from this... to this...

by CENTRILINE

Low water pressure due to friction loss can be permanently corrected by Centrilining. Properly applied cement-mortar linings in pipelines eliminate interior tuberculation and corrosion forever.
The continuous rigid surface also prevents leakage from joints or holes in the pipe wall.
And it's all done with the pipes in place. The result is the equivalent of a new pipeline at a fraction of the cost of new pipe.
Write today for free booklet!

CEMENT-MORTAR LININGS FOR PIPES IN PLACE

VISIT CENTRILINE AT BOOTH 37-38
A.W.W.A. CONVENTION • SEATTLE, MAY 23-28

CENTRILINE CORPORATION
A subsidiary of Raymond Concrete Pile Co.
140 CEDAR STREET, NEW YORK 6, N. Y.
Branch Offices in Principal Cities of United States and Latin America

New Publications

Porcelain Enamel as Building Material. Technical and manufacturing developments in the application of porcelain enamel in the building industry are covered in the Proceedings of the recent two-day Conference on Porcelain Enamel in the Building Industry just issued by the Building Research Advisory Board. The eighteen major papers cover the most important factors in the use of porcelain enamel on metal, from an examination of chemical and physical properties to actual architectural uses and practical field experience. The 160-page publication sells for $6, with quantity discounts available. Requests should be sent to the Building Research Advisory Board, 2101 Constitution Avenue, Washington 25, D.C.

Equipment Operation. In a 150-page paper-bound volume, entitled *How to Operate Excavation Equipment*, Herbert L. Nichols, Jr., supplies detailed non-technical information on how to run the important types of excavating, hauling, and grading machinery. He has omitted the details of mechanical design and of specific jobs, which will be discussed in later books, and for safety's sake has refrained from telling how to start the machines. Everything else the operator needs to know, the book will tell him. Copies, priced at $1.50 each, may be obtained from North Castle Books, 212 Bedford Road, Greenwich, Conn.

Flood Control in Asia and the Far East. Issuance of the Proceedings of the Technical Conference on Flood Control—organized by the United Nations Economic Commission for Asia and the Far East and held at New Delhi, India, in January 1951—is announced by the Commission. Identified as Flood Control Series No. 3, the 320-page illustrated volume consists of 32 papers from member countries in the Commission and the various specialized agencies of the United Nations. Subjects include: Methods of Flood Control; Flood Problems of International Rivers; Sediment Problem; and Use of Hydraulic Models in Flood Control. The volume, priced at $3.00 or the currency equivalent, may be obtained from the Secretariat, Economic Commission for Asia and the Far East, Bangkok, Thailand, or from the United Nations, New York, N.Y.

Highway Cost Allocation. The incremental or differential costs method of allocating highway costs equitably among different types and weights of vehicles is described in a recent joint report of the Ohio Department of Highways and the U.S. Bureau of Public Roads entitled *Allocation of Highway Costs in Ohio by the Incremental Method*. The report brings to a conclusion earlier State Highway Department studies on highway financing based on data furnished by the Automotive Safety Foundation. The author is D. F. Pancoast. Inquiries should be sent to the Ohio Department of Highways, Columbus 15, Ohio.

Mississippi River Flow Data. Detailed tabulations of daily river stages and discharges for the Mississippi are made available in a 32-page paper-bound publication entitled *Stages and Discharges, Mississippi River and Its Outlets and Tributaries*, recently released by the Mississippi River Commission. Copies are $1 each, and may be obtained from the Commission, Corps of Engineers, Vicksburg, Miss.

Asphalt Surface Treatment. Experiments in retention of stone cover by asphalt surface treatment are reported by Fred J. Benson, A.M. ASCE, and Bob M. Gallaway in Bulletin 133 of the Texas Engineering Experiment Station. The experimental work, which was based on study of two aggregates and four types of asphaltic materials, was performed in the laboratories of the Department of Civil Engineering at Texas A & M College. Free copies are available from the Texas Engineering Experiment Station, College Station, Tex.

Earthquake Research. Studies of earthquake intensity and related ground motion are the subject matter of a 100-page, paper-bound volume by Frank Neumann, director of the Seismological Station at the University of Washington. Issued by the University of Washington Press, the volume is the first thorough analysis of strong motion seismograph data and earthquake intensity information collected over a 20-year period for federal and state agencies active in earthquake investigation. Copies of *Earthquake Intensity and Related Ground Motion* may be obtained from the University of Washington Press, 111 Thomson Hall, Seattle 5, Wash. The price is $1.50 a copy.

Parking Problems. References to most of the significant material on automobile parking in this country during the past seven years are given in a 126-page book issued by the Highway Research Board as Bibliography 14. The publication contains comprehensive author, subject, and geographic indexes, in addition to 1,128 annotations. Requests for copies should be sent to the Highway Research Board, 2101 Constitution Avenue, Washington 25, D.C. The price is $1.35.

National Science Foundation. Activities of the National Science Foundation during the year ending June 30, 1953, are summarized in the *Third Annual Report of the National Science Foundation*, now available from the Government Printing Office, Washington 25, D.C. The price is 40 cents.

Sedimentation. As an aid in the solution of sedimentation problems, the Department of the Army has released a compilation of the Subcommittee on Sedimentation of the Federal Inter-Agency River Basin Committee as Sedimentation Bulletin No. 5. Copies of the publication, entitled *Summary of Reservoir Sedimentation Surveys for the United States Through 1950*, are available for limited distribution at the Washington office of each of the agencies represented on the Subcommittee on Sedimentation—the Departments of Agriculture, Commerce, Interior, and Health, Education and Welfare; the Federal Power Commission; and the Tennessee Valley Authority.

Glossary of Terms. To meet a long-felt need for standardized definitions of the many terms pertaining to waves, tides, currents, and beaches, the Council on Wave Research of the Engineering Foundation has issued a 113-page *Glossary of Terms and List of Standard Symbols*. Inquiries concerning the publication, which sells for $1, should be referred to the Engineering Foundation, 33 West 39th Street, New York 18, N.Y.

Is this a record?
We think so!

One of Fairchild's high-flying photo crews on foreign assignment, taking full advantage of an unusual break in the weather, turned in an outstanding performance of 7609 square miles of aerial photography in one day—*an area exceeding that of the entire states of Connecticut and Delaware!*

But speed is only a part of the Fairchild story. First civilian organization to perform ultra-high altitude aerial photography, Fairchild's 34 years of experience assures a sound engineering approach to your problems, on-time performance, and a completed workmanlike job.

For your next aerial survey problem—water power, irrigation, highway, railroad, pipeline location, geologic studies, airborne magnetometer mapping *call Fairchild.*

Mapping programs during 1954 in eleven countries on four continents

FAIRCHILD
AERIAL SURVEYS, INC.

224 East Eleventh Street, Los Angeles, Calif.
Room 4630, RCA Bldg., 30 Rockefeller Plaza, New York

RECENT BOOKS

Les Terrains Perméables

This small book by A. Mayer, on permeable soils discusses the theoretical aspects of subterranean flow and deals concisely with a number of related practical problems: wells and the injection sealing of soils; seepage under dams and other structures; drainage in general; and a brief comparison between underground and surface reservoirs. (Dunod, Paris, second edition, 1954. 148 pp., Ffrs. 940.00.)

Tables of Offsets from Tangent to Parabolic Vertical Curves

A new and useful book is now available to engineers required to figure vertical curves. The book by D. S. Slatkin gives offsets for every foot of vertical curve for curves from 100 ft to 2400 ft in length. The tables are particularly useful in highway work where the P.C. or P.T. usually falls between stations. (Edward W. Sweetman, 1 Broadway, New York, N.Y., 1954. 238 pp., $5.)

The Mechanics of Engineering Soils

Based on published literature and the experience of the authors, P. Leonard Capper and W. Fisher Cassie, this book explains the basic principles of soil mechanics, describes the more usual tests, and introduces the reader to some of the practical applications of the subject. Several sections have been rewritten in the new edition, notably those on shearing resistance, bearing capacity, pavement design, and flow nets, and a new section on soil suction has been added. (McGraw-Hill Book Co., Inc., 330 West 42nd St., New York, N.Y., second edition, 1953. 315 pp., $6.50.)

1954 Heat Transfer and Fluid Mechanics Institute

These sixteen papers by specialists cover a wide range including heat and mass transfer under various conditions, heat transfer at hypersonic mach number, shock wave research, heat transfer from liquid metal, convection in electric fields, boiling characteristics, flow of water-air mixture, cavitation, and flame propagation research. (Held at University of Southern California, Los Angeles. Stanford University Press, Stanford, Calif., 1953. 240 pp., $5.50.)

Public Roads of the Past
Vol. II: Historic American Highways

An account of significant incidents in the development of highway transportation in colonial America and the United States during more than four centuries. Over 100 short articles cover a variety of historical and technical topics from the coming of the horse to America to the modern express highway. (American Association of State Highway Officials, 917 National Press Building, Washington 4, D.C., 1953. 183 pp., $4.)

Timber, Its Structure and Properties

Written in non-technical language for the user of wood, this summary of modern wood technology, by H. E. Desch, consists of four parts: Parts I, II, and III cover structure and classification, gross features and identification, and the physical properties of wood; Part IV, on wood utilization, deals with seasoning, defects, pests, preservation methods, timber grading, and briefly with wood as an engineering material. (St. Martin's Press, Inc., 103 Park Ave., New York 17, N. Y., third edition, 1953. 350 pp., $6.)

Vegetation and Watershed Management

A comprehensive survey of the control of water on the land by vegetative means, providing an appraisal of vegetation management in relation to water supply, flood control, and soil erosion. Intended for civil engineers, reclamation technicians, hydrologists, range managers, and agriculturists, the author, E. A. Colman, summarizes achievements and points out further research needed. Sponsored by the Conservation Foundation. (Ronald Press Co., 15 East 26th St., New York 10, N.Y., 1953. 412 pp., $7.)

Forced Oscillations in Non-Linear Systems

Chihiro Hayashi presents a detailed treatment for engineers and physicists, dealing only with systems having one degree of freedom. It applies a comprehensive method of analysis to a wide variety of periodic oscillations; Part I dealing with steady state conditions; Part II, with the transient state of oscillations leading to the steady state. Emphasis is on the comparison of conclusions derived from theory with experimental investigations carried out using electrical oscillatory circuits with saturable iron cores as the non-linear element. (Nippon Printing and Publishing Company, Ltd., Osaka, Japan, 1953. 164 pp., $4.50.)

Applications for Admission to ASCE, March 13–April 10

Applying for Member

CLARENCE ALBERT BADER, Detroit, Mich.
HARLO PETER BESCHENBOSSEL, Pierre, S.D.
VIGGO CHRISTIAN BERTELSEN, Washington, D.C.
HARRY BREIMEISTER, Milwaukee, Wis.
DAVID JOHN CLEASBY, Los Angeles, Calif.
BENJAMIN COTTRELL, Richmond, Va.
GEORGE B. CRITESER, San Francisco, Calif.
JOHN PAUL ELLIOTT, Denver, Colo.
DEMARCUS D. FORGEY, Seattle, Wash.
EUGENE FRANCIS GIBBONS, New York, N.Y.
WILLIAM DAVID GLENN, Nashville, Tenn.
HAROLD BENJAMIN HEMBORG, Arcadia, Calif.
HUGH WELLS HETZER, Charleston, W. Va.
HERBERT MARTIN IHLING, Milwaukee, Wis.
LIONEL ROWAN INGRAM, San Francisco, Calif.
ERIC RIVERS JACOBSEN, Sao Paulo, Brazil.
WILLIAM JACKSON JONES, San Francisco, Calif.

(*Continued on page 117*)

Kroger supermarket in Glendale, Missouri. Architect: Cay Weinel, St. Louis, Missouri. Contractor: White Development Corporation, St. Louis, Missouri.

EASY DOES IT

... with lightweight, versatile

LACLEDE STEEL JOISTS

Fast placing and erection . . . combined with modern design and strength make Laclede Steel Joists the answer to today's needs in roof construction.

Specify these LACLEDE Products:

Multi-Rib Reinforcing Bars • Steel Pipe • Welded Wire Fabric
Form and Tie Wire • Spirals • Conduit • Corrugated Steel Centering

LACLEDE
Products of Construction Steel
LACLEDE STEEL COMPANY
St. Louis, Mo.

Imperial

THE *Finest*

TRACING CLOTH

Imperial is known in drafting rooms all over the world as the traditional quality tracing cloth.

With the background of decades of experience, its makers have pioneered in modern improvements to maintain Imperial as the finest tracing cloth made.

THE FINEST WRITINGS OF CIVIL ENGINEERS

Transactions Vol. 118

Just Issued

Containing advanced principles and practice in all civil engineering fields, it has a place in every engineer's library.

To members:		*To other subscribers:*	
Paper Bound	$2.00	Paper Bound	$16.00
Cloth Bound	3.00	Cloth Bound	17.00
Morocco Grained	4.00	Morocco Grained	18.00

Special discount to libraries

A limited number of Volume 117 and earlier issues are also available. Prices on request.

AMERICAN SOCIETY OF CIVIL ENGINEERS

33 West 39th St. New York 18, N. Y.

Please send Vol. 118 in ..... binding

Amount enclosed ..... $.....

(I am) ..... (I am not) ..... a member of ASCE.

Name .....

Street .....

City ..... State .....

☐ Enter my standing order for future Transactions in binding indicated.

ASCE CENTENNIAL TRANSACTIONS

The Centennial volume of Transactions, contains papers presented at the Centennial Convention of ASCE in September, 1952. Prominent authors have provided papers describing advances in all technical branches of civil engineering. Those who have not previously ordered this volume can do so now using the following coupon:

THE AMERICAN SOCIETY OF CIVIL ENGINEERS

33 West 39th Street, New York 18, N. Y.

	Members		Non-Members
	First Copy	*Additional Copies*	
Paper	$3.00	$ 9.00	$18.00
Cloth	4.00	10.00	19.00
Morocco Type	5.00	11.00	21.00

I enclose $ ..... for which please send ..... copies bound in .....

NAME .....
(please print)

ADDRESS .....

CITY ..... ZONE .... STATE .....

Applications for Admission to ASCE

(*Continued from page 115*)

GEORGE JOSEPH KUPCHIK, New York, N.Y.
PAUL LAURENCE MAHER, New York, N.Y.
JOHN DANIEL MCDONALD, Springfield, Mass.
GUSTAVO MESA ARANGO, Colombia, S.A.
WILLIAM LEON MYERS, Roanoke, Va.
STEPHEN JOSEPH MICHUDA, Chicago, Ill.
ROBERT BROWNING MIDKIFF, Knoxville, Tenn.
LUTHER RICE MILLS, JR., Atlanta, Ga.
ALFRED OBOLER, Miami Beach, Fla.
LEX SNEED OWENS, Montgomery, Ala.
JOSEPH ERNEST PILLOW, Charleston, W. Va.
NORMAN MAXWELL PRITCHETT, Baltimore, Md.
DONALD FERNALD ROACH, Concord, N.H.
LUIS P. SAENZ-DUPLACE, Havana, Cuba.
JOHN FRED SCHAFFER, El Paso, Tex.
WALDEMAR EDWARD SCHNEIDER, Denver, Colo.
CARL LOUIS SHERMER, East Lansing, Mich.
DAVID BARTLETT SLOAN, New York, N.Y.
HENRY WITHERS SPRIDEN, Morgantown, W.Va.
WILSON WALDO TOWNE, Cincinnati, Ohio.

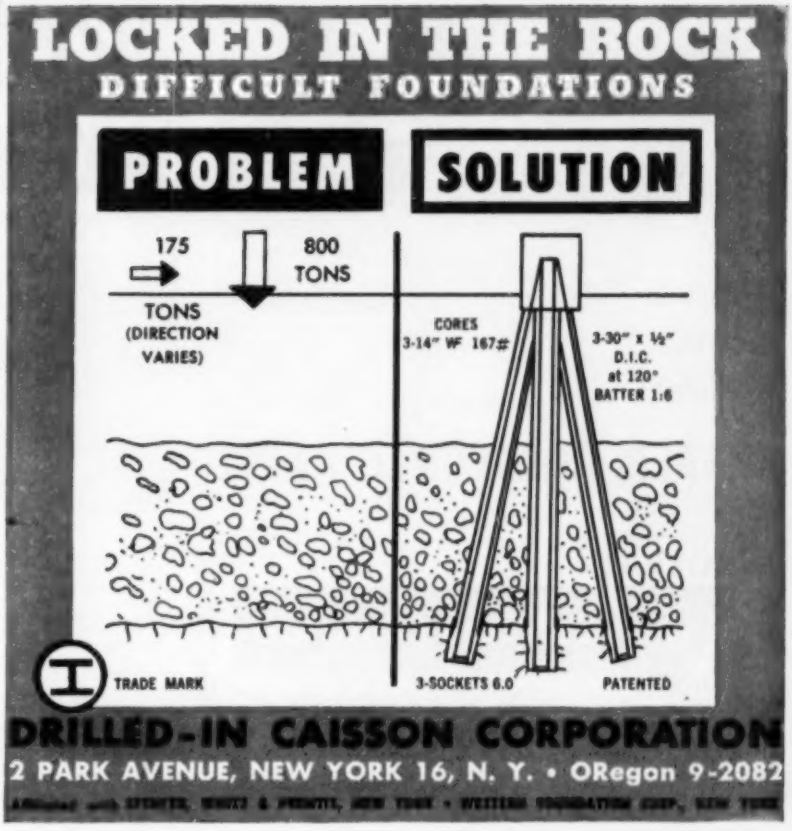
Applying for Associate Member

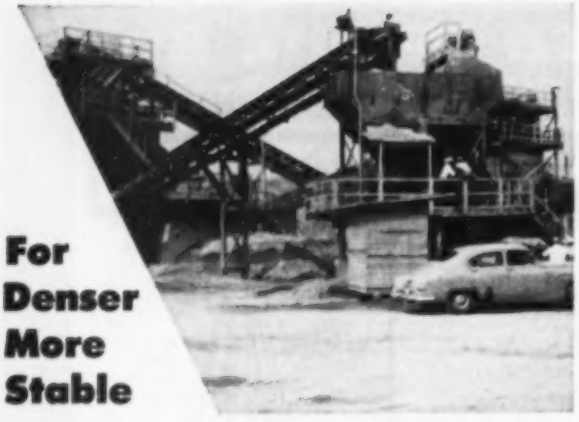
HERMAN MAY ANDREAS, Dallas, Tex.
PAUL STEPHAN DONALD BASSON, Pretoria, S. Africa.
ROBERTO BENGCO BAUTISTA, Marianas Islands, Guam.
EDWARD JOHN BIVES, JR., New Orleans, La.
JAMES CECIL DALTON, San Francisco, Calif.
ROY DRAGONE, Baltimore, Md.
ULF RAMM ERICSON, Schroeder, Minn.
DOUGLAS WELLINGTON FLETCHER, Detroit, Mich.
PAUL OTTO GADDIS, Forest Park, Ill.
JOSEPH WILLIAM KOERGEL, Cuyahoga Falls, Ohio.
AUGUST EUGENE KUIPER, Sacramento, Calif.
ANDREW LEE MAIDOX, Belle, W. Va.
DUNBAR BENSON MULHAUSEN, Wilmington, Del.
MARTIN EDWARD NILIUS, Independence, Calif.
CORNELIUS WILLIAM O'LEARY, Seattle, Wash.
WILLIAM HENRY OSWALT, III, Midland, Tex.
NIRANJAN PAUL, West Bengal, India.
PAUL THOMAS REYNOLDS, Coral Gables, Fla.
BRUCE EVERETT ROBERTS, Salina, Kan.
JAMES LEE RODGERS, Scottsboro, Ala.
KARL ROESSER, Milwaukee, Wis.
FREDERICK CHURCH SANDERSON, New Haven, Conn.
WILLIAM ARTHUR SIDLER, San Bernardino, Calif.
THOMAS SPHAR SMITH, Pittsburgh, Pa.
GORDON ROBIN STANDBROOK, Sydney, Australia.
CHARLES STRALEY, Cincinnati, Ohio.
GODRATOLLAH TASHAKORI, Tehran, Iran.
TERRY TRIFFET, China Lake, Calif.
UMA KANT VERMA, Nihar, India.
PANANGIPALLI VISWANATH, Andhra, India.
ROBERT BEN WADDILL, Independence, Mo.
FREDERICK PAUL WIESINGER, Chicago, Ill.
RICHARD AXEL WILSON, Stockton, Calif.
NICOLAS ANDREW MIKLASZEWSKI ZAWADOWSKI, Chile, S. A.

Applying for Junior Member

WILLIAM CHARLES BLACK, Bethlehem, Pa.
EDWARD CHARLES BLALOCK, Montgomery, Ala.
JOHN EDWARD BUHL, JR., Bethlehem, Pa.
EDWARD HENRY BULTMANN, JR., Urbana, Ill.
DOUGLAS RAY BROWN, Sacramento, Calif.
PAUL TOWNSEND CARVER, Roswell, N. Mex.
ERNEST EUGENE CLAY, Los Angeles, Calif.
GENE THEODORE DAVIS, Shelby, N. C.
DONALD RUSSELL DOWNS, Shreveport, La.
MOHAMMAD AMANUL HUQ ENVER, Bahawalpur State, Pakistan.
ROBERT LOUIS FENELON, Rhinelander, Wis.
J. ROY GARBER, Hammond, Ind.
NARENDRA NAGESH GUNAJI, Belgaum, India.
SAMI MICHEL HADDA, San Francisco, Calif.
FRANCIS XAVIER HALL, New York, N. Y.
EUGENE FRANCIS HAWLEY, Detroit, Mich.
JEAN-BAPTISTE FRANCOIS HOCEPIED, Bruger, Belgium.
MONROE MARION JOHNSTON, Atlanta, Ga.
JAMES LOUIS KINDRED, San Antonio, Tex.
MARION JACKSON KOPETZ, Kansas City, Mo.
GEORGE MOTOI MATSUMURA, San Francisco, Calif.
EDWARD JOHN MCCULLOCH, Portland, Me.
PATTIPATI PRATAPA MOWLI, Jodhpur, India.
PAUL RICHARD NARBY, Portland, Me.
EDWARD KEITH NEUBAUER, Milwaukee, Oreg.
DENNIS ANTHONY O'LEARY, El Cajon, Calif.
CLEMENT PORS, Casablanca, French Morocco.
WILLIAM BALTHIS SANDS, Decatur, Ill.
ROBERT WILLIAM SHULDES, Chicago, Ill.
GUY FRANK TABOR, JR., Portland, Me.
CHARLES URAY, JR., Youngstown, Ohio.
ROBERT HANS VATERLAUS, Tuckahoe, N. Y.
ALFRED WARREN WATSON, Passaic, N.J.
CHARLES LUTHER WETZLER, Minneapolis, Minn.
LYNDAL ELWIN WIELE, Richland, Wash.
JOHN HENRY WRIGHT, Knoxville, Tenn.
JAMES FREDERICK YOST, Stockton, Calif.

[*Applications for Junior membership from ASCE Student Chapters are not listed.*]





For Denser More Stable

GRADED AGGREGATE BASES

use

SOLVAY Calcium Chloride

The addition of SOLVAY Calcium Chloride to graded aggregate base courses will provide:

- **Quicker compaction at less cost!**
- **Substantial added protection against frost action!**

Base courses containing SOLVAY Calcium Chloride can be used as wearing courses without dusting or ravelling.

Send for FREE "Better Bases" Book

"Better Bases for Better Surfaces" contains authoritative information, data, photographs, charts, graphs, illustrations, mixture requirements and material specifications. No cost or obligation—write for your copy today!

Keep Unpaved Surfaces

DUSTLESS, COMPACTED SMOOTHER-RIDING

***economically** and **easily**—with Low-Cost, Clean, Odorless* **SOLVAY Calcium Chloride**

SOLVAY Calcium Chloride is the inexpensive, efficient way to eliminate dust. It is easy to use on gravel, limestone, cinder, crushed stone and similar unpaved surfaces. Calcium Chloride can be quickly applied by regular maintenance personnel no experience or expensive equipment is necessary.

Free Literature Available on Calcium Chloride Treatment of Unpaved Surfaces

MAIL COUPON NOW

SOLVAY PROCESS DIVISION
Allied Chemical & Dye Corporation
61 Broadway, New York 6, N. Y.

Allied Chemical

Gentlemen: Please send me — WITHOUT COST OR OBLIGATION:

☐ "Better Bases for Better Surfaces"
☐ "Calcium Chloride Surface Consolidated Roads"

Name .....

Title .....

Address .....

City ..... Zone ..... State CI-5

ACCURACY IS OUR WATCHWORD

MODEL 2 c F
$960.00

The superior accuracy of a Warren-Knight is our most envied possession. It is achieved by the skilled hand craftsmanship of guild instrument makers. That's why a Warren-Knight is most prized by so many engineers and constructors.

How a Warren-Knight saves time and money!

- Sturdier construction for longer life.
- Extra reinforcing for rough handling.
- Extra fine coated lenses—close focus 4½ feet—for convenience.
- Disappearing Stadia to eliminate errors.
- Graduations differentiated size and slant for sure reading.
- Right angle peep right through telescope angle to save time.
- Non-cramping leveling head for ease of handling.
- Replaceable leveling screws for low maintenance.
- Leveling screw threads covered to eliminate dirt.

Send for free catalog CE 45

WARREN-KNIGHT

136 NORTH 12TH STREET PHILADELPHIA 7, PA.

Complete Service and Equipment for

SWIMMING POOLS

National Pool offers the most complete line of highest quality POOL SUPPLIES and EQUIPMENT obtainable. The experienced staff of National Pool stands ready to assist you in problems of POOL DESIGN, ENGINEERING, CONSTRUCTION and MAINTENANCE.

Write for our free pool booklets and equipment catalog.

NATIONAL pool equipment co.

2516 Eighth Court North, Birmingham, Alabama.

AURORA, ILLINOIS *Also* REDUCES SEWER MAINTENANCE COSTS WITH "*Flexibles*"

We believe Aurora's satisfaction with its new "Flexible" SeweRodeR can best be told from these excerpts from a letter written January 30, 1954.

"We received our SeweRodeR . . . on or about January 5, and would like at this time to advise that this machine has already reduced our sewer maintenance costs and we feel it will be a great advantage to our city to have it . . . we have found a lot more can be accomplished with the SeweRodeR each day and with less manpower. All the work is done from the street level by lowering the auger with a rope to the main. Would also like to compliment Mr. W. G. Weichel who demonstrated . . . and trained our men to operate it.

"If at any time we can be of service to you by demonstrating the machine to anyone who is interested, please feel free to call on us.

Very truly yours,
GEORGE ORLAND
Commission of Public Property
City of Aurora, Illinois."

Note: The "Flexible" SeweRodeR not only takes 9/10 of the usual hard work out of cleaning sewers . . . but permits preventative maintenance to be carried on without interference by weather.

Write for our **FREE** *Catalog*

Flexible **SALES CORPORATION**

3786 Durango Ave., Los Angeles 34,
(DISTRIBUTORS IN PRINCIPAL CITIES)

AMERICA'S LARGEST LINE OF PIPE CLEANING TOOLS AND EQUIPMENT

SOCIETY JEWELRY AVAILABLE

Executive Secretary
American Society of Civil Engineers
33 West 39th Street
New York 18, N. Y.

Enclosed is my check for $_____ for the purchase of:

For Members (M., A.M., and Aff.)

☐ Badge (pin)	$5.50
☐ Badge (watch charm)	5.50
☐ Lapel Button	3.30
☐ Tie Clasp	4.95
☐ Tie Chain	9.35

For Junior Members

☐ Badge (pin)	$2.20
☐ Badge (watch charm)	2.20
☐ Lapel Button	1.38

(Prices listed include 10% Federal Excise Tax. This tax is not payable on export orders.)

Name .....
(please print)

Address .....

City .....
(where emblem is to be sent)

UNDERWATER SURVEYS MADE EASIER

Fast . . . accurate and permanently recorded

SURVEY DEPTHOMETERS • RADIO TELEPHONES • DIRECTION FINDERS • RADAR

Bludworth Marine's Supersonic Survey Recorders make underwater surveys faster with exceptional accuracy. A must for channel dredging, salvage or coastal construction. Reveals character of bottom material while recording depth.

BLUDWORTH MARINE

Precision built electronic navigation equipment since 1926

92 Gold Street, New York 38, N. Y.

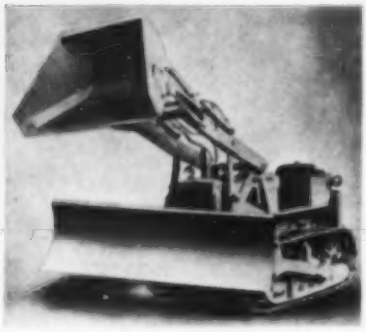
DIVISION OF NATIONAL — SIMPLEX — BLUDWORTH, INC.

EQUIPMENT, MATERIALS and METHODS

NEW DEVELOPMENTS OF INTEREST AS REPORTED BY MANUFACTURERS

Terra-Builder

THE PRODUCTION of a new, larger size Terra-Builder with ¾ yd digging bucket and 7'4" heavy duty angledozer or 6' bulldozer, has just been announced. This unique combination equipped with dual, big capacity, earthmoving equipment fills the complete equipment needs of the medium-size contractor with one machine.



Unique Combination

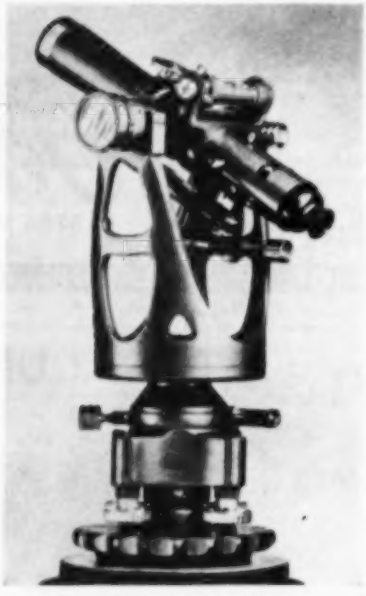
The bucket operates as a digging loader, leveler, materials handling loader and backfiller. The ATC special bucket is tapered for self-cleansing in, even the stickiest soils. The independent angledozer or bulldozer attachment incorporates the design features of giant equipment. Close coupled, direct hydraulic linkage permits precision performance when pushing heavy loads or land leveling or grading. Two full tractors in one, no extra hydraulics, the Terra-Builder is thousands of dollars lower in price than comparable equipment. Of unique ATC "design application," this terratrac machine is still light enough to be moved on any light dump or stake truck. **American Tractor Corporation, CE5-120, Churubusco, Ind.**

Universal Bevel Protractor

A UNIVERSAL Vernier Bevel Protractor with "Lustro-Chrome" dull chrome finish over the entire measuring dial is announced. This finish eliminates all glare, making measurements easy to read, and protects the surface from rust and corrosion. All parts of the tool are made in a sturdy thickness of .100" preventing deflection and assuring utmost accuracy. Any angle can be measured to 5 minutes by means of the Vernier. Regularly equipped with 6" blade, additional 12" blade can be furnished, also a stand with precision lapped base which can be set up on shafts as well as on flat surfaces. The price is very attractive at $25.00 including wooden case. **George Scherr Company, CE5-120, 200 Lafayette Street, New York 12, N. Y.**

Optical Instruments

TWO NEW instruments, a jig transit and an optical transit square, have been introduced which make it possible to reduce errors in alignment to less than one-thousandth of an inch. The new tooling aids are designed to establish and maintain a vertical plane for setting points accurately and speedily in assembly work, for gauging wear in tools and dies, and for general aligning purposes. They offer the extreme precision, flexibility and mobility associated with optical tools. They can be used from within a range of 17 in. to infinity. The jig transit is a special



Brunson Jig Transit

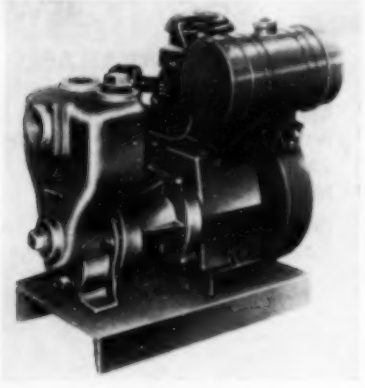
version of the Brunson Engineer transit, modified to fill the need for which it is intended. It has a mirror mounted on the end of the telescope axis and paralleling the line of sight; it has a telescope of higher power and shorter minimum focus; and it has no scale because a scale is not needed. Provision is also made for necessary adjusting in order to center the line of sight directly over the spindle. The optical transit square represents an extension of the jig transit application. The instrument resembles the jig transit but has a hollow axis. One end of the axis is enclosed by a clear window, the other by a partially coated window which is transparent enough to see through but which also has enough reflective quality to serve as a mirror. Because of these two characteristics, transparency and ability to reflect an image, a number of optical squares can be set up on one main line of sight. **Charles Bruning Company, CE5-120, Chicago 41, Ill.**

Dragline Bucket

A light weight dragline bucket has been developed with lip and toothpoints cast of high manganese steel for maximum resistance to wear and shock when digging clay, earth, sand or gravel. Unusually sharp teeth mounted in bases cast integral with the thin but strong cast lip, enable every pound of this light weight bucket to penetrate and cleanly dig these materials. This combination of digging ability and decreased deadweight on the boom mean more payload per pass. **The Page Engineering Company, Dept. RL, Clearing Post Office, Chicago 38, Ill.**

Centrifugal Pumps

THE DEVELOPMENT of a new improved line of lightweight, heavy duty, self-priming contractors type centrifugal pumps has been announced. The Universal design incorporates the following features; a new balanced priming port, preventing loss of volume from re-circulation of water, non-clogging semi-open impellers with adjustable clearance to compensate for wear, and a new convertible wear plate to prevent wear on the impeller case. These new pumps are rated for continuous duty as well as for inter-

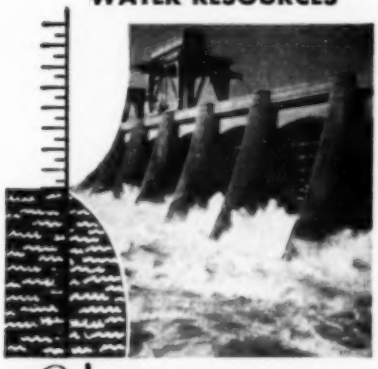


New Universal Pump

mittent service, and exceed the A.G.C. standards in every respect. New heavy duty units are especially suited for use by the building contractor for dewatering excavations as well as by the farmer for draining of ponds and ditches, and are constructed to handle muddy or unclear water and specially designed for drainage or any other application where rapid movement of large volumes of water is desired. Self-priming pumps are available in a wide range of horsepower ratings with choice of electric motor, gasoline engine or heavy duty transmission head for belt drive. **Universal Manufacturing Co., CE5-120, Berkeley, Calif.**

BASIC DATA

FOR UTILIZING WATER RESOURCES



With STEVENS WATER LEVEL RECORDERS

graphic, visual or audible registration ... local or remote

The planning of any project which involves the utilization of water resources is based on flow data which can be obtained from STEVENS water level recorders. And STEVENS recorders are equally important in the efficient operation of the completed project.

STEVENS instruments have been a standard of quality since 1907. They are at work compiling data on all major hydroelectric and flood control projects, and in water works, sewage disposal plants, irrigation and industrial installations in all parts of the world.

Consult with STEVENS hydraulic instrument specialists before planning any water measurement or control installation.

STEVEN'S *Data Book*

... a must for your reference file

$1.00

Puts interpretive data at your finger tips. 144 pages of technical data ... information on float wells and recorder installations ... a wealth of hydraulic tables and conversion tables.

Order Your Copy Today

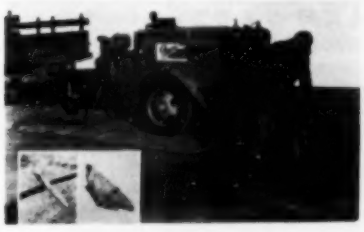
LEUPOLD & STEVENS INSTRUMENTS, INC.

4445 N. E. Glisan St., Portland 13, Ore.

Equipment, Materials & Methods (Continued)

New Joint Sealer

A NEW JOINT sealer was recently used at Carswell Air Base, Fort Worth, Texas, and marked the informal introduction of a much needed piece of equipment, long awaited by paving contractors. Here, for the first time, a $\frac{1}{8}$ in. sawed contraction joint was completely filled, top to bottom and 3 in. deep, in a continuous operation. The new joint sealer that did it combines, in one compact heavy-duty unit, all the equipment necessary for properly melting the sealing compound and for its correct application-under-controlled-pressure directly from "Kettle to Crack." The heart of the Clipper Joint Sealer is an oil-jacketed, tube fired "double boiler" kettle, designed for fast and safe heating of rubber base asphalt compound. Of rugged welded construction, the trailer type unit complete with yoke is mounted on heavy-duty automotive axle assembly for towing to any job site and for complete maneuverability alongside the joints to be



sealed. Heating is accomplished by multiple horizontal torch type burners, using bottled propane gas from two 15 in. containers mounted on the rear of the kettle. Kettle capacity is 165 gal and the melting production rate is 40 gal per hr. One of the many features incorporated in the sealer is the developed applicator bar, tipped with special alloy heat-treated steel nozzles in various widths for use in contraction joints $\frac{1}{8}$ in. and wider. **Clipper Manufacturing Co., CE5-121, 2800 Warwick Boulevard, Kansas City, Mo.**

Digger

A NEW, MEDIUM size, all-purpose digger is ideal for speedy digging of holes for setting telephone poles, fencing and guard rails. It is also suited for foundation work, soil sampling, tree planting, agricultural work, shallow wells, strip mining, etc. The unit has proven highly successful in soil investigations for foundation purposes as well as for locating clay, kaolin and other deposits. With a standard spiral auger head, the digger can bore holes up to 20" in diameter and to depths of 10 ft. By using sectional, continuous flight augers, depths up to 75 ft can be reached. A special pavement

(*Continued on page 122*)

FITTING ... IN EVERY WAY

For Further Information on Irving Gratings, Write

IRVING SUBWAY GRATING CO., INC.

ESTABLISHED 1902

OFFICES and PLANTS at

5008 27th St., Long Island City 1, N. Y.

1808 10th St., Oakland 20, California

DIG DEEP——CARRY FAR

Slackline builds cofferdam across river gorge.

900-ft. Tautline conveys 4-cu. yd. bucket to dam site.

One man controls . . . a Sauerman Slackline or Tautline Cableway . . . that can reach out 1,000 ft. or more. The Slackline is unexcelled for deep digging, especially under water. The Tautline is best for long range aerial crane work.

Sauerman machines lift, haul and dump any bulk material. Installations span pits, ponds, rivers or canyons. Slackline sizes: ⅓ to 3½ cu. yds. Tautlines: up to 25 tons. Operation cost: just a few cents per cu. yd. handled. Consult Sauerman engineers for specific information on your particular requirements.

Write for Catalog C, Slackline Cableways; Catalog G, Tautlines.

SAUERMAN BROS., INC.
552 S. Clinton St., Chicago 7, Ill.

ONE MAN MATERIALS HANDLING

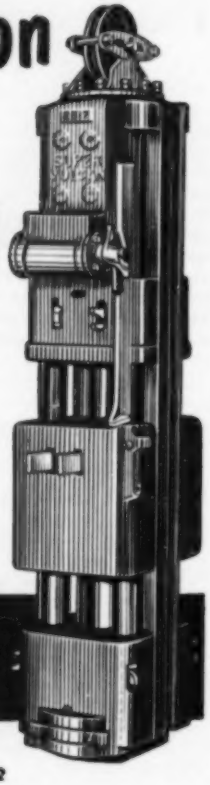
SAUERMAN BROS., INC.

Greater Penetration Per Blow

SUPER VULCAN

DIFFERENTIAL ACTING

PILE HAMMERS



Rugged strength, simple design, positive action. Delivers twice the usual number of blows per minute with 25 to 35 per cent less steam per blow.

WRITE TODAY FOR COMPLETE DETAILS AND NAME OF NEAREST DEALER

VULCAN IRON WORKS

Manufacturers of Pile Driving Hammers and Pile Extractors Since 1852
VULCAN IRON WORKS • 329 NORTH BELL AVENUE • CHICAGO 12, ILL.

Equipment, Materials & Methods (Continued)

test core attachment for cutting reinforced concrete is available. The Acker digger is the only machine available that provides angular adjustment of the drill head in two directions and permits operation at any angle through a full 360 deg range. With only five moving parts in the drill head, maintenance and normal wear are reduced to an absolute minimum. Hydraulic feed gives the operator sensitive and instantaneous control of the digging at all times. A built-in hoist and a sheave wheel at the top of the mast handles loads up to 750 lb, making the unit ideal for lifting or driving pipe. The mast can be raised or lowered by hydraulic power giving maximum road and garage clearance. Two models are available: a compact power take-off unit for jeep or power take-off truck mounting which is preferred by many users because it is extremely portable as well as lightweight; and the skid-mounted unit which is completely self-contained with its own separate power plant. The power plant can be any stock size, standard gasoline or diesel engine. **Acker Drill Company, Inc., CE5-122, Scranton, Pa.**

Compactor

THE VIBRATORY Multiple Compactor is shown compacting the sand fill enclosed by the abutment and wing walls of the bridge that will carry the Garden State Parkway over Indian Head Road. According to specifications it is said the sand, laid down in 12″ layers, must achieve 98% of maximum density in the

top four feet of depth, and 90% below that. Tests by the supervising engineers show that the requirements are being fully met. Advantages of the tamper on a job of this kind, are that in addition to very rapidly achieving the compaction desired, it can be operated in spaces too small for larger equipment and that it reaches into the corners inaccessible to such equipment. The machine consists essentially of six integrated vibratory units, 13′3″ in total width. It has working speeds of 0′ to 60′ per minute, reverse travel speed of 5½ miles per hr, and has found wide use as a rapid and efficient means of compacting and filling rock courses. For the really tight spots, one or more of the compacting units may be detached, fitted with an operating handle and utilized as a self-propelling manually operated compactor. **Jackson Vibrators, Inc., CE5-122, Ludington, Mich.**

Equipment, Materials & Methods (Continued)

Rear-Dump Trailer

THE ATHEY PR21 Rear-Dump Trailer, a high-production teammate of the Caterpillar DW21 Tractor, has just been offered to the public. The new team can haul 33 cu yd of any material at speeds up to 20 miles per hr. The trailer features a wide, open-mouthed body that makes an easy target for shovels, draglines, clamshells, chutes or other overhead loading devices. The body has a low overall loading height, tapering from 9′5″ at the front to 6′1½″ at the rear. A wide shield extends across the body to protect the tractor and operator. The body is sturdily constructed of ⅜″ high-strength steel and has a sandwich bottom with ¾″ armorplate as top layer, heavy oak planking filler, and a ½″ bottom plate. The DW21 is powered by a 6-cylinder Cat Diesel Engine that produces 225 hp at 1900 rpm. The 5½″ × 6″ bore and stroke engine burns No. 2 domestic burner

oil. Premium fuels are not required. The unit steers hydraulically with two double-acting pistons pivoting the tractor 90 deg in either direction. This provides an exceptionally low turning radius of 16′9″ with the body down or 13′5″ with the body up. The PR21-DW21 has undergone rigorous testing in a rock operation near Chicago. It has proved its worth where extremely narrow turning limits are encountered and where rock and other bulky material must be hauled. The trailer is interchangeable with the Cat No. 21 Scraper. It rounds out a line of ten haulers for use with Cat rubber-tired Tractors and is offered by Caterpillar dealers throughout the world. **Athey Products Corporation, CE5-123, 5633 W. 65th St., Chicago, Ill.**

Blasting Machine

MAXIMUM safety and reliable performance for the user of industrial explosives are provided by a new portable blasting machine of the condenser discharge type which is generator operated. It is believed to be the first condenser discharge type blasting machine utilizing a high voltage DC generator directly connected to charge the condensers. The generator is used instead of dry-cell batteries which require replacement, cannot deliver full power in severe cold weather, and give

(*Continued on page 124*)

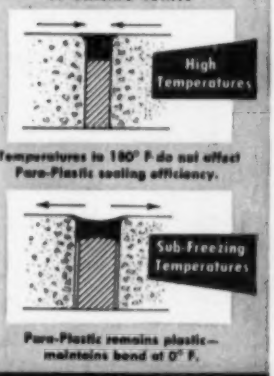
STOP JOINT SEAL FAILURES!

Use HOT-POURED *Para Plastic*

- ***Para-Plastic keeps joints sealed under severest conditions of traffic, temperature***
- ***May be pumped directly into joint from melting kettle***
- ***Para-Plastic "JF" compound impervious to Jet Fuel or petroleum solvents used in aircraft***

Use Hot Poured Para-Plastic . . . field-proved to be the only effective method of sealing joints with a high degree of permanence. There's no substitute for Para-Plastic . . . nothing equals its sealing performance. It's stable, constant in volume, won't break down and maintains bond under virtually every condition. Para-Plastic can now be pumped directly into the joint from the melting kettle—a fast, simple method of application. Write for details on new method and information on Para-Plastic and Para-Plastic JF.

The only FIELD PROVED METHOD OF SEALING JOINTS



SERVICISED PRODUCTS CORPORATION
6051 WEST 65th STREET • CHICAGO 38, ILLINOIS

send for this catalog describing acker's new all-purpose digger

Send the coupon today for your copy of our new catalog showing the wide range of application as well as the many exclusive features that make the *Acker All-Purpose Digger* the most versatile and useful you can buy!

TWO MODELS TO CHOOSE FROM — Jeep mounting with compact, power take-off or skid-mounted with self contained power plant for truck mounting.

ACKER DRILL CO., Inc.
725 W. Lackawanna Avenue, Scranton, Penna.
Please send me free copy of Bulletin 40. CE

Name_____ Title_____
Firm_____
Street_____
City_____ State_____

flatten cost curves with UNIVERSAL Flat-base pipe

conduits

highways

industry

Pre-cast concrete pipe saves up to 30% over built-in-place methods. Easy installation. Up to 100 feet of UNIVERSAL Flat-base pipe can be laid and covered in one day!

Built for heavy duty, low maintenance. Flatten your cost curves . . . specify UNIVERSAL Flat-base concrete pipe. Write . . . we'll tell you more.

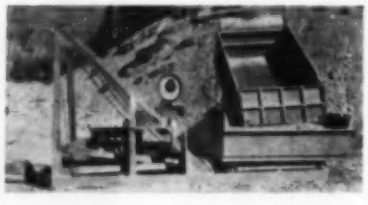
THE UNIVERSAL CONCRETE PIPE COMPANY
297 SOUTH HIGH STREET
COLUMBUS 15, OHIO
A subsidiary of the American-Marietta Co.

Equipment, Materials & Methods (Continued)

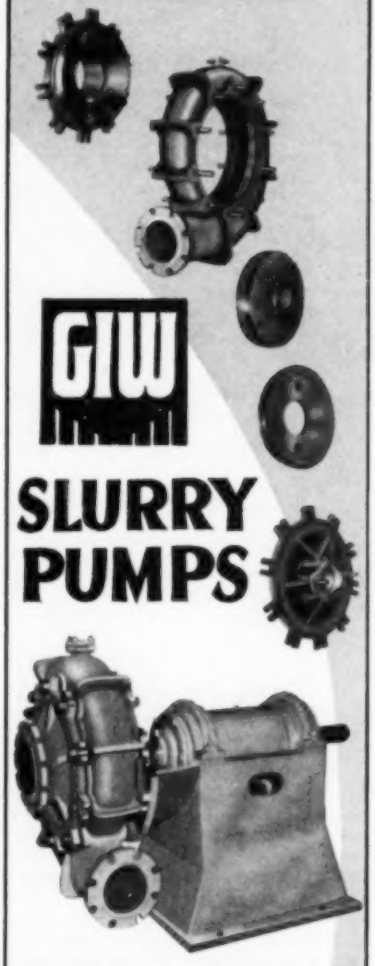
no indication of their state of charge or discharge. The new machine is completely self-contained and always ready for use. A specially wound, permanent magnet DC generator is hand-cranked through a train of gears which permits cranking speeds to remain moderate. To prevent firing before the condenser is fully charged, an accurate relay is wired into the firing circuit. Although the actuating button can be depressed while the operator is building up the charge in the condensers, the firing circuit cannot be closed (and the explosive fired) until the condensers are delivering a full 450 volts to the relay. A built-in voltmeter affords an accurate check on the charge in the condensers, which at peak is approximately 450 volts. It has adequate capacity to fire up to 50 caps in parallel, and up to 1,200 when properly connected in a single shot. Because the charge is developed by a generator, there exists no possibility of any residual charge, with its lethal hazard of accidental detonation of the explosive. The new machine is weatherproof and will even withstand brief accidental immersion. **Fidelity Instrument Corp., CE5-124, York, Pa.**

Travel Batcher

A NEW MACHINE, the Travel Batcher, is being introduced to the ready-mixed concrete producers and to contractors where concrete is used on their jobs. It is designed to load truck mixers of any capacity, either at the job site or plant site. Because the batcher is easy to move, it can be used on many jobs in one day.



On jobs that cover a lot of area, it can be moved easily to keep up with the work. It has built in scales for weighing each batch up to 20,000 lbs at one time. It can be used to transfer batches from dump truck to truck mixer, as hopper is low enough to allow dump trucks to discharge into it and can be batched into from stock piles with any front end loader. On jobs of fair sized yardage the machine can be loaded from bins and can compete with stationary plants in producing volume concrete. From actual experience, the inventor has seen the need of having the material and concrete mixers at the job site where much better control of batches and timing can be had. **Southeast Ready-Mix Co., CE5-124, 6540 Holladay Boulevard, Salt Lake City, Utah.**

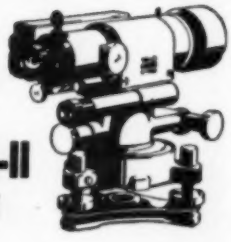


The performance of these pumps is remarkable. Their stamina and efficiency are documented by two years of laboratory and field tests. This is the happy answer to the problem of pumping highly abrasive slurries at high solid concentrations and over a wide range of heads and capacities. Their capacities range from 50 to 8000 GPM against heads up to 150'.

Write for our illustrated booklet. If you wish, there is a representative near you who will be glad to call if you desire.

GEORGIA IRON WORKS CO.
Twelfth Street, Augusta, Ga.

Another TRIUMPH for the WILD N-II PRECISE LEVEL



for Universal Application

Used by specialized surveyors in California's Sacramento Valley rice fields to produce precision-flat fields and to establish highly accurate levees on contour lines for controlling the flooding of enormous rice paddies... an engineering feat.

Because of its inherent accuracy and speed of handling, the WILD N-II PRECISE LEVEL was chosen for this specialized application by these unique surveyor-farmers.

WILD N-II is a Tilting Level, with or without horizontal circle, made for the *progressive surveyor* by the world's largest manufacturer of precision surveying instruments.

Its faster and extremely accurate results, even under adverse conditions, save costly man-hours.

- **Price $288.75 incl. metal "lunch box" carrying case.**
  Tripod Va, fixed legs, $38.00
  Tripod VIIb, extension legs, $52.25

F.O.B. Port Washington, N.Y.
Delivery from stock.

For Full Details Request Bklt. CE 5

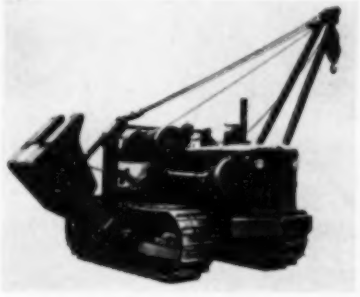
Full Factory Service by Specialists

HENRY WILD
SURVEYING INSTRUMENTS SUPPLY CO.
OF AMERICA, INC.
MAIN & COVERT STS., PORT WASHINGTON, N. Y.
POrt Washington 7-4843

Equipment, Materials & Methods (Continued)

Side Boom for Crawler Tractor

A NEW SIDE boom for a crawler tractor with a 38,000 lb lifting capacity at 4 ft overhang, is announced. It is the Model TSB-9 for the Allis-Chalmers HD-9F Tractor, 72 drawbar horsepower and is expected to fill the requirements of many pipe line contractors working with small diameter feeder and distribution lines. General contractors and others who work with sewer tile and conduit, water main, or any other job requiring big capacity, mobile lifting power will find many uses for the new side boom. Among many design improvements, two major features in this unit have been introduced. The first is a front-mounted power take-off



which has several advantages. It means the power is taken from a live shaft so that the side boom works independently of the tractor master clutch. Further, the front power take-off leaves the back of the tractor free for installation of a winch or other rear-mounted equipment which is often required in this size machine. The second new feature of the TSB-9 is the twin clutch arrangement on the power take-off. This consists of two multiple plate Twin Disc clutches, one for raise and one for lower. By merely pulling one lever, the operator can change from raise through neutral to power down on either the load or boom line. No gear shifting is necessary. **Tractomotive Corporation, CES-125, Deerfield, Ill.**

Pantograph

THE NEW OTT Precision Pantograph Small Type 500, is an instrument for reproducing exactly to an equal scale, reduced scale, increased scale-designs, stencils, patterns, drawings, stamps, etc., of any kind. Can be used on inclined drawing boards as well as on horizontal drawing boards. Is equally adapted for the position of the pole inside or outside the parallelogram. The exact millimeter divisions on the bars permit accurate settings for any ratio between 1:10 and 1:1. Can be folded into a compact case for easy and safe handling. Is being offered at the low cost price of $128.00. **Geo-Optic Company, Inc., CES-125, 170 Broadway, New York 38, N. Y.**

***Just out* — THE NEW REVISED AND ENLARGED 3rd EDITION OF**

ENGINEERING CONTRACTS and SPECIFICATIONS

By ROBERT W. ABBETT

The thorough revision of this well-known work incorporates latest information on legal considerations. The discussion of types of construction contracts includes new material on joint ventures and incentive-type contracts. Sections on cost-plus-fixed-fee contracts and contracts for engineering and architectural services have been entirely rewritten and enlarged to cover current professional practice. Much new material has been added throughout the book.

1954 429 pages $6.00

GRAPHICS in ENGINEERING and SCIENCE

By A. S. LEVENS

Here is a new and more effective approach to use of graphics in technology. Integrating phases of orthogonal projection, technical drawing practices, and graphical solutions and computations, it gives the reader a fuller appreciation of the graphic mode of expression. Explanations promote full understanding.

1954 696 pages Illus. $7.00

PRESTRESSED CONCRETE

By YVES GUYON

A masterly summary of information previously to be found only in widely scattered technical journals of seven countries. Also includes much new data, appearing here in print for the first time. Though Guyon's work has been closely associated with the Freyssinet system, his book is applicable to all methods of prestressing—both pre-tensioned and post tensioned.

1953 543 pages Illus. $12.00

MAIL NOW FOR FREE EXAMINATION

JOHN WILEY & SONS, INC.
440 Fourth Avenue, New York 16, N. Y.

Please send me the book(s) checked below ON APPROVAL. Within 10 days I will either return same and owe you nothing or will remit price(s) indicated plus postage.

- ☐ Engineering Contracts and Specifications, $6.00
- ☐ Graphics in Engineering and Science, $7.00
- ☐ Prestressed Concrete, $12.00

Name .....

Address .....

City ..... Zone ..... State .....

☐ SAVE POSTAGE. Check here if you ENCLOSE payment, in which case we pay postage. Same return privilege.

(CE-5-54)

ALWAYS ASK FOR

STEEL BY FLINT

STEEL
ERECTION
FABRICATION
DETAILING

If you need steel, any kind of steel — structural, galvanized, reinforcing bars and mesh or pans — ONE Call to Flint will secure it. DELIVERY can usually be made from our full stocks.

• STRUCTURAL • PLATE
• WAREHOUSE • REINFORCING
• GALVANIZED

FLINT STEEL CORPORATION
P. O. BOX 1289 TULSA, OKLAHOMA

BURN UP TO 50% MORE

. . with this

F & E INCINERATOR STOKER

Patents Pending

F&E Incinerator Stokers apply not only to new incinerator plants, but to many new existing furnaces. Results—up to 50% increased burning capacity; big reduction in labor; big reduction in maintenance.

F&E FLYNN & EMRICH CO.
301 N. Holliday St. ★ Baltimore 2, Maryland

Equipment, Materials & Methods (Continued)

Hydratork Drive

GAS-POWERED Clark Carloader-model fork trucks in 3000–5000 lb capacities are now available with Hydratork Drive, a transmission which does away with the need for gear shift, high and low gears and a clutch and clutch pedal. First introduced in 1953 after two years' development and a year's exhaustive field test of 18 pre-production models, it combines a torque converter with a simple constant-mesh transmission, making it possible to operate a gas-powered fork-truck with three simple controls, an accelerator, a

brake pedal and a forward-reverse selector lever located on the steering column. One of the outstanding advantages, is that it eliminates gear clashing during engagement. As a result, a major saving can be effected because of reduced maintenance requirements. Additional advantages of the Hydratork over other transmissions include smoother acceleration, more positive drive control at all times, less driver fatigue and controlled "inching" ability. **Clark Equipment Company, CE5-126, Battle Creek, Mich.**

Crusher

THE NEWEST addition to the Grizzly-King jaw crusher line is announced. It is a size 42 × 48 overhead eccentric crusher and is the largest of its kind in the world. It has a capacity of over 1200 tons an hr at the largest setting and at the 5" opening will run in the neighborhood of 800 tons per hr. Besides the advantage of tremendous capacity this machine will take larger size rocks, enabling the pit operator to space his blast holes farther apart, saving time and materials in his blasting operations. It also has excellent control over the product size required and lessens the need for additional secondary processing. Too, the well balanced design of this crusher results in almost imperceptible if any, vibration or lost motion giving longer cost free service, lower power requirements, less maintenance, and eliminates the need for costly substructures required by ordinary machines. **Lippman Engineering Works, CE5-126, Milwaukee 14, Wis.**

LEFAX ★ ★ ★

POCKET SIZE TECHNICAL DATA BOOKS $1.25 EACH

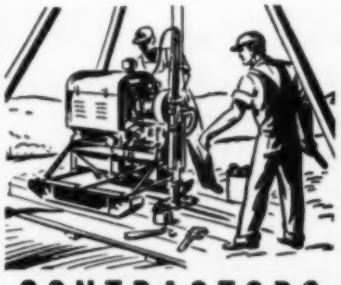
Printed on loose leaf, six hole, 6¾" × 3¾" bound paper, each book contains about 140 pages of technical data, presenting condensed, accurate and essential data for the student, engineer, technical worker and business man.

• • •

Architecture	Transformers, Relays, Meters
Home Heating	Hydraulics
Illumination	Surveying
Electrician's Data	Mech. Drawing
Builder's Data	Machine Design
Lumber Data	Machinists' Data
Air Conditioning	Piping Data
General Math.	Surveying Tables
Math. Tables	Trig-Log Tables
Physics	Metallurgy
Chemical Tables	Analytic Chemistry
Metals	Highway Engineering
Gen'l. Chemistry	Mechanics of Materials
Reinforced Concrete	Power Trans. Mach'y.
Building Construction	Thermodynamic Tables & Charts
Radio Television & FM	Phys. & Thermodynamic Data
Electricity, AC	Phys. & Org. Chemistry
Electricity, DC	
AC Motors and Generators	

Write for FREE Catalogs (over 2000 listings). See for yourself how helpful LEFAX can be to you. Send $1.25 for each book, or $6 for any five books listed above, to:

LEFAX, Dept. CIV-5 Philadelphia 7, Pa.



CONTRACTORS

for

DIAMOND CORE DRILLING
DRY SAMPLE SOIL BORINGS
FOUNDATION TESTING
PRESSURE GROUTING, ETC.
anywhere in the world

More than sixty years of successful experience backed by superior equipment and ample financial resources, constitute your best possible assurance of satisfactory service. Manufacturers, also of Diamond Core Drilling Machines and complete accessory equipment, including all types of Diamond Drilling Bits. Write for Bulletin No. 320.

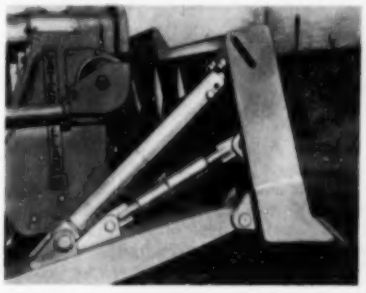
SPRAGUE & HENWOOD, Inc.
Dept. C. E., SCRANTON 2, PA.

New York - Philadelphia - Pittsburgh
Grand Junction, Col. - Bochara, Newfoundland

Equipment, Materials & Methods (Continued)

Bulldozer Stabilizer

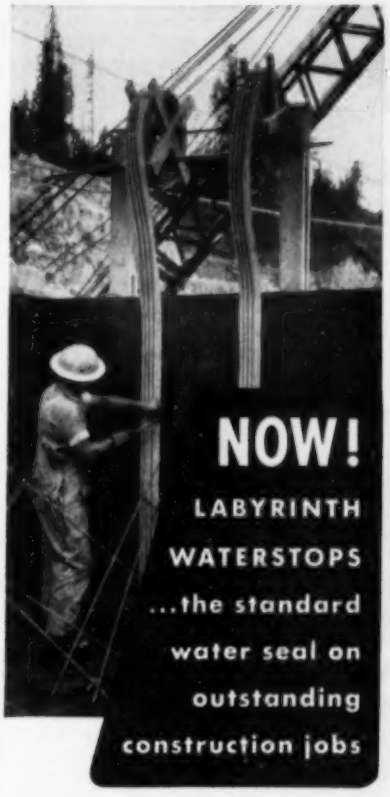
THIS STABILIZER eliminates all looseness in adjustable type bulldozers. With the installation of the stabilizer the dozer blade may be held rigid in a tilted or level position which is very essential to efficient operation of a bulldozer. It can be installed in the field with four brackets to weld and installing time of less than two hours.



It is of all-steel construction and is available for Caterpillar D6 and D7 dozers. It will also be in production soon for other makes and models. Actual use in the field for over a year has proven it to be an effective and economical means of restoring loose or worn dozers to their original stability. It will also prevent new dozers from becoming loose. **Schneckloth Excavating Company, CE5-127, Clinton, Iowa.**

Roller Conveyor

A NEW POWERED roller conveyor engineered for maximum safety and designed with smooth roller carrying surfaces to eliminate belt tracking problems and replacement costs is now being manufactured. It is used primarily for long-distance horizontal handling of materials that may vary widely in shape, size and weight. Articles can be stopped at any point on this conveyor for inspection, labeling, weighing or similar operation without interfering with the flow of goods at any other point along the line. The unit has carrier rollers and pressure rollers mounted in the same frame. A motor-driven belt runs between the two sets of rollers, activating the upper carrier rolls which rotate to carry materials along. The lower pressure rolls in any 5-ft section are easily adjusted up and down at any point on the unit to provide proper belt contact for straight carrying, accumulated loading, or sweep-on-sweep-off operations. The drive and take-up units are separate self-contained packages which can be mounted at any point on the under flange of the conveyor frame. The Rapistan LR is made up of 10 ft sections that can be combined to give unit lengths up to 150 ft. The unit is designed with outstanding safety features to protect personnel and materials handled. **The Rapids-Standard Company, Inc., Dept. LR, 342 Rapistan Building, Grand Rapids 2, Mich.**



• Quickly accepted by the nation's leading engineers and contractors, Labyrinth Waterstops—the first really satisfactory water seals—are now being used on all types of jobs...hydro electric plants, atomic energy plants, industrial plants, water and sewage plants, water reservoirs, underground and surface parking lots, swimming pools plus a host of lesser projects. (Names, and details furnished on request.) Why not get additional information on this time and money saving water seal? Just mail coupon below.

Eliminates seepage problems. Simplifies form work.

• • • • • • • • • • • •

WATER SEALS, INC.
9 South Clinton Street Dept. 1
Chicago 6, Illinois

Please send complete information on Labyrinth Waterstops,

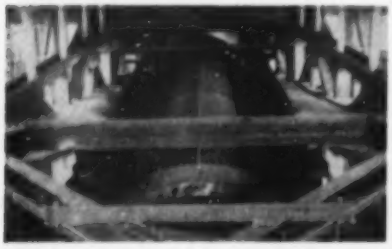
Name_____

Company_____

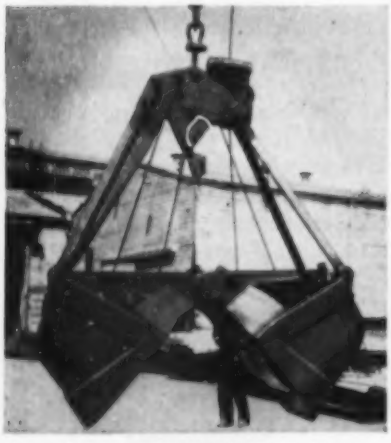
Address_____

City_____ Zone____ State_____

YUBA Bucket Ladder Dredges for dredging placer properties including rare earths, etc.; handling sand and gravel, dam construction, channel changes, etc., Bucket sizes: 2½ to 18 cu. ft. or larger. Digging depths below water as required.



YUBA Abrasion Resisting Steel Screens—Flat or revolving for separating, scrubbing, sizing. Holes taper drilled to prevent clogging. All thicknesses from ¼" up; other dimensions as needed. U·S·S· AR plate carried in stock.



Stockton "Yubabilt" Clamshell Buckets, for channel, harbor and reclamation dredging. Two types: California and Power Arm (shown here). Three weight classes: heavy, standard, special light weight. ½ to 6 cu. yds.

YUBA DREDGES — PROVED DEPENDABILITY THE WORLD OVER

57

YUBA MANUFACTURING CO.

Room 716 • 351 California St. • San Francisco 4, Calif.

Literature Available

WATER SYSTEMS—A new 96-page "Commercial Catalog C-54" now published, gives comprehensive data, construction details, and selection tables on twelve types of Deming water systems including the latest dual-purpose jet pumps (convertible for shallow or deep well service) and the submersible type of deep well pump. Miscellaneous units featured, include the new Motor-Mount centrifugal pump designed primarily for air conditioning service but applicable for booster service, general circulating service and industrial plant service. Four pages are devoted to illustrations and descriptions of a variety of advertising and sales promotional helps available for use by Deming distributors and dealers. **The Deming Company, CES-128, Salem, Ohio.**

PAVER ATTACHMENT—A new development, the Lorain TL-25 "Charge-a-Paver," is the subject of a four page booklet just released. A step-by-step explanation, complete with illustrations, describes fully how concrete highway paving costs are lowered and paver output increased with the use of this new front-end attachment. It is one of a series of interchangeable front-end attachments which may be used on the standard crawler-mounted "TL-25" turntable. Briefly, it consists of a box-like pan, 10 ft. long, 6 ft. wide, 14 in. deep which may be crowded and retracted, in-and-out, on a telescopic boom to transfer materials from batch trucks outside the subgrade to the Paver. **The Thew Shovel Co., CES-128 Lorain, Ohio.**

MATERIAL HANDLING DEVICE—The Benchevator, a new materials handling device that speeds work on anything handled in stacks or sheets, is described in Bulletin No. 14. It consists of a motor-driven, self-locking screw-actuated column, with a table top. This can be made any desired size to handle various kinds of work such as paper, paperboard, and sheet metals with a capacity up to 5000 pounds. Raising or lowering of the table top is controlled by a push button which can be located anywhere within easy reach of the operator's foot or hand. The bulletin described single unit operation and how two units can be adapted to handle incoming material and processed material. **Rodney Hunt Machine Co., CES-128, 22 Spruce St., Orange, Mass.**

INSULATION—A 4-page instruction folder discussing construction features and installation techniques is offered. Diagrams and illustrations demonstrate how to install between wood beams, steel beams and trusses, around ducts and pipes, on masonry walls, cement and wood floors and other shallow spaces. Answers problems like insulating damp cellar walls, crawl spaces, ventilation, vapor formation, etc. **Infra Insulation, CES-128, 525 Broadway, New York 12, N. Y.**

PHOENIX BRIDGE COMPANY

Engineers
Fabricators
Erectors

Structural Steel
BRIDGES and BUILDINGS

AISC

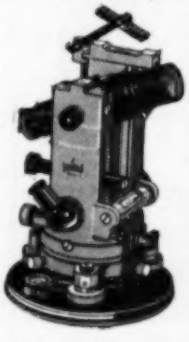
General Office and Shops

PHOENIXVILLE, PA.

Subsidiary—Barium Steel Corporation

ASKANIA

MIDGET OPTICAL READING
TRANSIT TK



with erecting eyepiece and optical plummet

HANDY
EASY
EFFICIENT
HIGHEST PRECISION

Reading 1' Estimation 6'
Instrument Weight 4 lbs.

★ LOW COST

ASKANIA-WERKE AG
Berlin • Friedenau

REPRESENTATIVE
GEO-OPTIC COMPANY INC
170 BROADWAY, NEW YORK 38, N. Y.

foundations
piling
underpinning
shoring
cofferdams
special services
CATALOGUE ON REQUEST
SPENCER, WHITE & PRENTIS INC
10 EAST 40TH STREET, NEW YORK 16, N. Y.
Detroit: Hammond Bldg. • Chicago: 134 So. La Salle St.
Washington, D. C.: Tower Bldg.
SPENCER, WHITE & PRENTIS OF CANADA, LTD.
Toronto: 700 Bay St.
Montreal: 2052 St. Catherine St., West

TIDE GATES

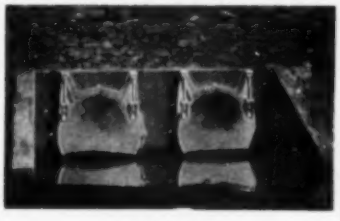


Fig. B-124-D
Two 60" Type M Gates on Relief Culverts near Woodward Pumping Station, Plymouth, Pa.

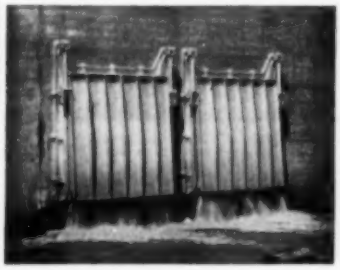


Fig. B-124-C
Two 72" x 72" Type M-M Gate on Toby Creek Outlet Works, Plymouth, Pa.

BROWN & BROWN, INC.
LIMA, OHIO, U.S.A.

Literature Available (Continued)

ROAD JOINT DEVICES—Information covering the full range of road joint devices for concrete highways and airstrips has been presented in a single comprehensive bulletin. This bulletin shows devices to meet all concrete pavement joint needs from the least expensive dowel baskets to the finest complete load transfer assemblies. These include lightweight dowel baskets, heavy type dowel supports and spacers such as used by the Army at McGuire Air Force Base at Wrightstown, N. J., and the brand new short dowel one-man type of load transfer assembly which was used by the Navy at Atlantic City Naval Air Station, and which is available with stainless steel dowels for special applications. Copies of the bulletin and price lists needed by contractors are available by requesting the Road Devices Catalogue. **Richmond Screw Anchor Co., Inc., CE5-129, 830 Liberty Ave., Brooklyn 8, N. Y.**

CHEMICALS—"Chemicals Used in Water Sewage and Waste Treatment," are tabulated and indexed in a new 16-page technical Bulletin, No. 10-K12. Information and data supplied on 50 chemicals includes; chemical formulas, principal uses, common names, forms in which chemical can be obtained, etc. Specific information is provided on feeding recommendations including; best feeding form, chemical to water ratio for continuous dissolving, types of feeders, accessory equipment required, and suitable handling materials. **Omega Machine Co., CE5-129, 345 Harris Ave., Providence 1, R. I.**

OIL FIELD & PIPE LINE EQUIPMENT—A new bulletin graphically illustrating with application photographs is offered on oil field and pipe line equipment. It contains specification information on many types of pumps, including those for water flooding, steam turbines and turbine-generators, oil, and dual fuel engines, "packaged" oil field compressors, various types of air and gas compressors, etc. Write to the Advertising and Sales Promotion Dept. for Bulletin WP-1099-B42F. **Worthington Corporation, CE5-129, Harrison, N. J.**

VIBRATORS—A ten-page booklet giving facts and figures on the application of external vibration in the manufacture of cast concrete pipe, is now available. It is based on several years experience of leading pipe manufacturers, and offers some general recommendations based on these experiences. It will be of special interest to those interested in concrete pipe manufacture. A 25 × 38 in. wall chart similar to the cutaway view shown on the inside back cover of the booklet, for users of either our Model PX7 or PX8 pneumatic external vibrators, is free upon request. **Viber Company, CE5-129, 726 South Flower St., Burbank, Calif.**

BRUNTON* POCKET TRANSIT save time by using it as a
COMPASS
TRANSIT
LEVEL
PLUMB
ALIDADE
CLINOMETER
it's handy for
PRELIMINARY AND SUPPLEMENTARY SURVEYING
and easy to carry
IN POCKET
ON BELT
IN CAR

*Brunton is a registered trademark of
WM. AINSWORTH & SONS, INC.
2151 LAWRENCE ST. • DENVER 2, COLORADO

You SET THE SPECIFICATIONS...

Special 4x6 Steam Fixed Drum Winch. Duty single line pull 4,300 lbs. at 90 FPM.

Superior-Lidgerwood-Mundy has the facilities and experience to meet them . . . either from an all-inclusive line of standard hoisting equipment or with equipment engineered to your specific requirements.

WRITE FOR BULLETINS AND CATALOGS

SUPERIOR LIDGERWOOD MUNDY CORPORATION

Main Office and Works: SUPERIOR, WISCONSIN, U. S. A.
New York Office, 7 Dey Street, New York 7, N. Y.

Automatic Water Control Gates

CONTROLS WATER LEVELS AUTOMATICALLY

Developed in France, proven in North Africa, U.S. irrigation and power companies report this gate unequaled to control water levels, assure equitable distribution, 24 hours a day in canals, reservoirs, forebays, etc.

Entirely self operating . . . saves cost of gate keeper . . . prevents costly washouts and flood damage.

There may be an installation near you for inspection. Write for information.

Accurate Parshall Measuring Flumes

Accurately measures water in open ditches and canals, regardless of water velocity. Ideal for sewerage and water treatment plants. Settles water disputes.

Self cleaning . . . easy to read. Built of corrosion-resistant galvanized steel for long life. Approved by state engineers. Write for details and prices.

MAIL TODAY

THOMPSON PIPE & STEEL CO.
3017 Larimer Street, Denver 1, Colorado

Gentlemen: Please send me without obligation pictures and data on water control equipment.

Name_____

Address_____

City_____ State_____

THOMPSON PIPE & STEEL COMPANY

Films Available

SILICONES—A new movie now being released is called, "What's a Silicone?" It's a 32 minute, sound and color, 16mm movie designed for engineers. As the name implies, it shows what silicones are and how an engineer can use them to advantage. The movie is fast moving and covers a lot of territory. It begins with the structure of these amazing new engineering materials and demonstrates the properties of silicones as compared to organic materials and shows their wide application by engineers in nearly all industries. Write to Technical Information Service. **Dow Corning Corp., CE5-130, Midland, Mich.**

STEEL—A catalog listing several films is now available on a free loan basis for showing to all recognized groups. Among the films offered are: "An Orchid to Mr. Jordan," an outstanding commercial film in Technicolor, dramatically portraying the production, fabrication, and application of USS Stainless Steel; "Building for the Nations," a fascinating Kodachrome motion picture on the building of an important skyscraper, the Secretariat Building of the United Nations; and "New Neighbor," an impressive documentary motion picture of a miracle in Delaware Valley. Information may be obtained from George J. Dorman, Manager, Motion Picture & Visual Aids Section, Advertising Division, **United States Steel Corp., CE5-130, Pittsburgh 30, Pa.**

STRADDLE CARRIER—Applications of the straddle carrier type of industrial trucks in the metalworking, canning, construction, distilling, petroleum, lumber, manufacturing and other industries are portrayed in a 25-minute sound film now available. Titled "Over-The-Load Materials Handling," the film was shot on location at plants all over the country, so that typical operations of the straddle carrier in a wide variety of industries could be covered and consists of eight sequences. **Clark Equipment Company, CE5-130, Battle Creek, Mich.**

V-BELT DRIVES—The second group in a series of educational 35mm sound slidefilms for industry is now available. The three slidefilms are on the subject of v-belt drives and each run about 20 minutes. They are titled "In Every V-Belt Drive," "For Better Driving," and "Selecting a Drive." The first, in color, covers the engineering principles that are basic in every v-belt drive application. The second concerns itself with the installation and maintenance of multiple v-belt drives. The third tells how to check characteristics to find the best type of drive and then engineer it to do the job. Requests for showings of any of these slidefilms should be made to the nearest **Allis-Chalmers General Machinery Division district office. CE5-130.**

Servicised

Resin Base Concrete Curing Compound

- Does not alter appearance of concrete
- Dries rapidly, forms clear, vapor-tight membrane . . . assures positive control of curing
- Readily accepts paint or adhesives after curing

Servicised Resin Base Curing Compound is recommended for curing exposed concrete such as pavement slabs, bridges, abutments, walls, etc. Sprayed or painted, it forms a uniform membrane capable of holding moisture in the concrete to assure proper curing.

Write for complete details and circular on Servicised Concrete Curing Compounds.

SERVICISED PRODUCTS CORPORATION
6051 West 65th Street, Chicago, Illinois

HYDROLOGY HANDBOOK

SOCIETY MANUAL NO. 28

192 pages

Authoritative reference in a growing field

Thirty-three specialists have collaborated to present up to date coverage on

Precipitation
Infiltration
Run-Off
Evaporation and Transpiration

Continuous demand for this manual evidences its wide acceptance by teachers and practicing engineers.

Use this handy order blank

☐ . . . copies paper covers (non members) $3.00 each
☐ . . . . (members) $1.50 each
☐ . . . cloth .. .. (non members) $4.00 each
☐ . . . . (members) $2.50 each

Payment is enclosed herewith

Name . . . . . .

Address . . . . . Grade Membership . . . .

City . . . . . .

PROCEEDINGS AVAILABLE

The following papers have become available as Proceedings-Separates. Following the date of issue of a paper, discussions thereof will be received for a period of three months, as specified on the cover of the paper. Titles will be added to this list every month, as they become available. Technical division sponsorship is indicated by an abbreviation at the end of each item, the symbols referring to: Air Transport (AT), City Planning (CP), Construction (CO), Engineering Mechanics (EM), Highway (HW), Hydraulics (HY), Irrigation and Drainage (IR), Power (PO), Sanitary Engineering (SA), Soil Mechanics and Foundations (SM), Structural (ST), Surveying and Mapping (SU), and Waterways (WW) divisions. Papers issued prior to, and including, Separate No. 289, were not distributed under the present automatic mailing system. If you have not registered in a Technical Division to receive its papers (one Division only) free of charge, please do so promptly by filling out and mailing the enrollment and subscription form (page 133) to Society Headquarters. For ordering separate papers, use the convenient order form on page 132.

Listed in Earlier Issues

342. **The Problems of Civil and Structural Design of Steam Electric Plants for the Pacific Gas and Electric Company in Central California,** by W. L. Dickey. (CO)

343. **Design and Research for Welded Structures,** by LaMotte Grover. (ST)

344. **Steel for Welded Bridges and Buildings,** by Simon A. Greenberg. (ST)

345. **Fabrication and Construction of Structural Steel for Buildings,** by C. L. Kreidler. (ST)

346. **Statutory Control of Ground Water,** by S. T. Harding. (IR)

347. **Use of Colorado River Water in California,** by Raymond Matthew. (IR)

348. **Construction of the Elizabeth River Trench-Type Tunnel,** by Joseph Peraino. (CO)

349. **Aseismic Design of Elastic Structures Founded on Firm Ground,** by L. E. Goodman, E. Rosenblueth, and N. M. Newmark. (ST)

350. **Construction of the Inter-American Highway,** by E. W. James. (HW)

351. **Vertical Sand Drains for Stabilization of Muck-Peat Soils,** by J. C. Carpenter, and Edward S. Barber. (HW)

352. **Concepts of Engineering Biotechnology in Occupational Health,** by Alvin F. Meyer, Jr. (SA)

353. **The Importance of Shoran Surveying in the Southern Hemisphere,** by Carl I. Aslakson. (SU)

354. **Hydraulic Fundamentals of Closed Conduit Spillways,** by Fred W. Blaisdell. (HY)

355. **Statistical Review of Dam Construction,** by Robert A. Sutherland. (PO)

356. **The Development of the Pulp and Paper Industry in the South,** by A. G. Wakeman. (CO)

357. **A Mathematical Examination of Spiraled Compound Curves,** by T. F. Hickerson. (HW)

358. **Intrusion of Sea Water in Tidal Sections of Fresh Water Streams,** by C. P. Lindner. (HY)

December

359. **Development of Miami International Airport,** by Earle M. Rader. (AT)

360. **Strength Characteristics of Compacted Clays,** by Gerald A. Leonards. (SM)

361. **Pressure Surge Control at Tracy Pumping Plant,** by John Parmakian. (HY)

362. **Graphical and Theoretical Analysis of Step-Drawdown Test of Artesian Well,** by M. I. Rorabaugh. (HY)

363. **Field Penetration Tests for Selection of Sheepsfoot Rollers,** by S. J. Johnson and W. G. Shockley. (SM)

364. **High Intensity Rainfall and Major Floods in Puerto Rico,** by Miguel A. Quinones. (HY)

365. **Effect of Well Screens on Flow into Wells,** by Jack S. Petersen, Carl Rohwer, and M. L. Albertson. (HY)

366. **Frequency of Excessive Rainfalls in Florida,** by David B. Smith. (HY)

367. Discussions of PROCEEDINGS-SEPARATES 151, 172, 173, and 174. (SU)

368. Discussions of PROCEEDINGS-SEPARATES 148 and 166. (WW)

369. **Unsteady Flow in Open Type Pipe Irrigation Systems,** by E. H. Taylor, A. F. Pillsbury, T. O. Ellis, and G. A. Bekey. (IR)

370. Discussions of PROCEEDINGS-SEPARATES 172, 173, and 174. (AT)

371. Discussions of PROCEEDINGS-SEPARATES 106 and 228. (SM)

372. Discussions of PROCEEDINGS-SEPARATES 150 and 226. (CO)

373. Discussions of PROCEEDINGS-SEPARATES 150, 170, 245, and 306. (ST)

374. Discussions of PROCEEDINGS-SEPARATES 157, 202, 223, 299, and 300. (EM)

375. **Deflections of a Circular Beam Out of Its Initial Plane,** by Enrico Volterra. (EM)

376. **Electrical Analogs of Statically Loaded Structures,** by Frederick L. Ryder. (EM)

377. Discussions of PROCEEDINGS-SEPARATES 130, 208, and 231. (SA)

378. Discussions of PROCEEDINGS-SEPARATES 160, 162, 294, and 308. (PO)

INSTRUCTIONS

1. Papers are to be ordered by serial number. Please keep a record of Separates you have received to avoid unwanted duplication.

2. Every ASCE member registered in one of the Technical Divisions will receive free, automatically, all papers sponsored by that Division. **Such registration will be effective the first of the month following the receipt of the registration form.**

3. Members' accounts will be charged at 25¢ each for every paper ordered specially. Charges for papers ordered prior to August 1, 1954, will be included on the 1955 dues bills.

4. Non-members of the Society may order copies of Proceedings papers by letter with remittance of 50¢ per copy, members of Student Chapters, 25¢ per copy.

Standing orders for all Separates in any calendar year may be entered at the following annual rates: Members of ASCE, $12.00; members of Student Chapters, $12.00; non-members, $20.00, plus foreign postage charge of $0.75; libraries, $10.00.

Standing orders for all Separates from any one Division in any calendar year (excepting papers of a Division in which a member registers for free copies), may be entered at $2.00 per year—by members only.

TRANSACTIONS. Specially selected PROCEEDINGS papers with discussions, will be included in TRANSACTIONS. Annual volumes of TRANSACTIONS will continue to be available at the currently established annual subscription rates.

	To Members	To Non-Members
Morrocco-grained binding	$4.00	$18.00
Cloth binding	3.00	17.00
Paper binding	2.00	16.00

January

379. Discussions of PROCEEDINGS-SEPARATES 155 and 215. (SM)

380. **Master Library List of Fluid Mechanics and Hydraulic Engineering Titles: Progress Report of the Committee on Research of the Hydraulics Division.** (HY)

381. **Open Channels with Nonuniform Discharge,** by Wen Hsiung Li. (HY)

382. **Hydraulic Model Studies of Martin Dam Draft Tubes,** by Carl E. Kindsvater, and R. R. Randolph, Jr. (HY)

383. **Backwater Functions by Numerical Integration,** by Clint J. Keifer and Henry Hsien Chu. (HY)

384. Discussions of PROCEEDINGS-SEPARATES 153, 169, and 175. (HY)

385. **Pile Foundations for Buildings,** by John W. Dunham. (SM)

386. **Pavlosky's Theory for Phreatic Line and Slope Stability,** by K. P. Karpoff. (SM)

387. **An Experimental Study of Bubbles Moving in Liquids,** by W. L. Haberman and R. K. Morton. (EM)

388. **Water Supply Engineering: Report of Committee on Water Supply Engineering of the Sanitary Engineering Division for the Period Ending September 30, 1953.** (SA)

389. Discussions of PROCEEDINGS-SEPARATES 152, 271, and 305. (SU)

390. **A New Concept of Flow in Rough Conduits,** by Henry M. Morris. (HY)

391. Discussions of PROCEEDINGS-SEPARATES 140, 142, and 156. (IR)

392. **Sanitary Engineering Aspects of Atmospheric Pollution,** by Louis C. McCabe. (SA)

393. **Surveys and Maps for Pipelines,** by George E. MacDonald. (SU)

394. **Airports and Aviation in Latin America,** by Kenneth E. Calender. (AT)

395. Discussions of PROCEEDINGS-SEPARATES 167 and 231. (SA)

396. Discussions of PROCEEDINGS-SEPARATES 185, 223, 250, 258, and 281. (EM)

397. Discussions of PROCEEDINGS SEPARATES 158, 183, 187, 201, and 219. (ST)

February

398. **Economic Effect of Irrigation in a Subhumid Area,** by Willis C. Boegli. (IR)

399. **Reservoir Malaria Control and Sanitation Problems,** by Frank B. Wood. (SA)

400. **The Function of the Laboratory in Engineering Construction,** by George H. Nelson. (CO)

401. Not immediately available.

402. **Planning of Air Force Bases,** by Paul C. Brown. (AT)

403. **Planning of the Modern Air Base,** by Paul J. Houfek. (AT)

404. **Irrigation Potentialities in Arkansas,** by Paul H. Berg. (IR)

405. **Civil Engineering Features of Delta Steam Electric Station,** by George E. Archibald. (PO)

406. **Development of an International Airport,** by Earle M. Rader. (AT)

407. **Aerial Surveys for Reservoir Planning,** by Francis J. Guscio. (SU)

408. **Georgia's Proposed Plat Law,** by C. R. Roberts. (SU)

409. **Deep Water Harbors in the Southeast,** by D. P. Billard. (WW)

410. **Planning an Airport,** by Paul H. Stafford. (AT)

411. **Industrial Waste Process Design,** by W. Wesley Eckenfelder, Jr., and Donald J. O'Conner. (SA)

412. **Coal-Handling Design for TVA Steam Plants,** by George P. Palo. (PO)

413. **Backwater Effects of Open Channel Constrictions,** by H. J. Tracy and R. W. Carter. (HY)

March

414. **Navigation on the Warrior-Tombigbee River System,** by Ralph W. Mueller. (WW)

415. **The Mapping of Buford Reservoir,** by F. C. Riley. (SU)

416. **Soil Problems in the Southern Piedmont Region,** by George F. Sowers. (SM)

417. **Fill Utilization for Building Foundations,** by Gordon B. Dalrymple. (SM)

418. **Testing for Construction and Evaluation of Airport Pavements,** by Clifford J. Chunn and Frank M. Bell. (AT)

419. **Twin Opportunities: Conservation and Engineering,** by Clarence Cottam. (SA)

420. **Sewage Problems Resulting from the Kraft Process,** by W. A. Moggio. (SA)

421. **Airport Terminal Building Design,** by H. Orville Varty. (AT)

422. **Treatment and Disposal of Atomic Energy Industry Wastes,** by Joseph A. Lieberman and Arthur E. Gorman. (SA)

423. **The Training of City Planners,** by Howard K. Menhinick. (CP)

424. **Base Course and Bituminous Pavement Requirements,** by W. J. Turnbull and O. B. Ray. (AT)

425. **Soil and Geologic Features of the Buford Project,** by William V. Conn. (SM)

426. **Humid Area Soils and Moisture Factors for Irrigation Design,** by Fred H. Larson. (IR)

427. **Sediment Sampling in Tidal Waterways,** by E. A. Schultz. (WW)

April

428. Discussion of PROCEEDINGS-SEPARATES 139, 146, and 178. (HY)

429. Discussion of PROCEEDINGS-SEPARATES 202, 286, 287, and 300. (EM)

430. **Field Data for the Structural Design of Coal Bunkers,** by Herman Tachau and Ibrahim M. Mostafa. (ST)

431. **Morning-Glory Shaft Spillways: Prototype Behavior,** by J. N. Bradley. (HY)

432. **Morning-Glory Shaft Spillways: Determination of Pressure-Controlled Profiles,** by W. E. Wagner. (HY)

433. **Morning-Glory Shaft Spillways: Performance Tests on Prototype and Model,** by A. J. Peterka. (HY)

434. **Analysis and Tests of a Cylindrical Shell Roof Model,** by Bruno Thurlimann and Bruce G. Johnston. (ST)

For the Use of ASCE Members Only

PROCEEDINGS PAPERS ORDER FORM

AMERICAN SOCIETY OF CIVIL ENGINEERS

33 W. 39 ST., NEW YORK 18, N.Y.

Enter my order for separate PROCEEDINGS Papers which I have circled below. My account is to be charged at the rate of 25¢ for each Separate ordered.

342	343	344	345	346	347	348	349	350	351	352	353	354	355	356
357	358	359	360	361	362	363	364	365	366	367	368	369	370	371
372	373	374	375	376	377	378	379	380	381	382	383	384	385	386
387	388	389	390	391	392	393	394	395	396	397	398	399	400	402
403	404	405	406	407	408	409	410	411	412	413	414	415	416	417
418	419	420	421	422	423	424	425	426	427	428	429	430	431	432
433	434													

If more than one copy of a paper is desired, indicate here:

_____

_____

Name (*please print*) Membership Grade

_____

Address

_____

_____

Signature Date

Professional Services

Listed alphabetically by states

EWIN ENGINEERING CORPORATION
Design and Construction
Investigations, Reports, Appraisals, Estimates and Management Surveys, Port Facilities, Foundations, Industrial Plants, Bridges and Structures
P. O. Box 361 — Mobile 3, Ala.

PALMER & BAKER, INC.
Consulting Engineers and Architects
Tunnels — Bridges — Highways — Airports — Industrial Buildings — Harbor Structures—Vessels, Boats & Floating Equipment—Soils, Material & Chemical Laboratories
Mobile, Ala. — New Orleans, La.
Washington, D. C. — Houston, Texas

JOHN S. COTTON
Consulting Engineer
Hydroelectric, irrigation, water supply, and multiple purpose projects, flood and erosion control, river basin development planning, dams and their foundations, tunnels, marine structures, valuations, rates.
28 Brookside Drive, San Anselmo, Calif.

DAMES & MOORE
Soil Mechanics Engineering
Los Angeles • San Francisco
Portland • Seattle • Salt Lake City
New York • London
General Offices, 816 West Fifth Street
Los Angeles 17, Calif.

FAIRCHILD AERIAL SURVEYS INC.
Aerial Photography • Contour Maps
Explorations Surveys • Airborne Magnetometer Surveys • Shoran Mapping
• City Maps • Highway Maps
224 E. 11th St., Los Angeles 15
4630—30 Rockefeller Plaza, New York
Boston — Seattle

D. B. GUMENSKY
Civil and Structural Engineer
Investigations, planning, location design, construction, costs.
Hydro-electric power, water supply dams, tunnels, unusual structures.
Domestic and foreign.
1047 Sierra St., Berkeley, Calif.
Tel. Landscape 6-10183

INTERNATIONAL ENGINEERING COMPANY, INC.
Engineers
Investigations—Reports—Design
Procurement—Field Engineering
Domestic and Foreign
74 New Montgomery St.
San Francisco 5, California

MAURSETH & HOWE
Foundation Engineers
Soil Investigations – Laboratory Testing
Consultants – Engineering Geology
Construction Supervision
Offices and Laboratories: 8953 Western Ave., Los Angeles 47, Calif.
Eastern Associate: George R. Halton, Newark, N. J.

KAISER ENGINEERS
Division of Henry J. Kaiser Company
ENGINEER – CONTRACTOR
Investigations – Reports – Valuations
Design – Construction
Twinoaks 3-4600
1924 Broadway — Oakland, Calif.

ENGINEERING SERVICES INC.
Foundation Investigations—Complete Test Boring Service—Field and Laboratory Soil Testing—Mineral Resource Explorations
325 Laurel St., Hartford 5, Conn.

DUVAL ENGINEERING & CONTRACTING CO.
General Contractors
FOUNDATION BORINGS
For Engineers and Architects
Jacksonville — Florida

RADER ENGINEERING CO.
Water Works, Sewers, Refuse Disposal, Ports, Harbors, Flood Control, Bridges, Tunnels, Highways, Airports, Traffic, Foundations, Buildings, Reports, Investigations, Consultations
111 N.E. 2nd Avenue — Miami, Florida

ALVORD BURDICK & HOWSON
Consulting Engineers
Water Works, Sewerage, Water Purification, Sewage Treatment, Flood Relief, Power Generation, Drainage, Appraisals.
20 North Wacker Drive, Chicago 6, Ill.

CONSOER, TOWNSEND & ASSOCIATES
Water Supply, Sewerage, Flood Control & Drainage, Bridges, Express Highways, Paving, Power Plants, Appraisals, Reports, Traffic Studies, Airports, Gas and Electric Transmission Lines
351 East Ohio Street, Chicago 11, Ill.
9½ Indiana St., Greencastle, Ind.

DeLEUW, CATHER & COMPANY
Consulting Engineers
Transportation, Public Transit and Traffic Problems
Industrial Plants, Grade Separations Railroads, Subways, Power Plants, Expressways, Tunnels, Municipal Works
150 N. Wacker Drive, 79 McAlister St.
Chicago 6, Ill. — San Francisco 2

GREELEY AND HANSEN
Samuel A. Greeley, Paul E. Langdon, Thomas M. Niles, Kenneth V. Hill, Samuel M. Clarke
Richard H. Gould
Water Supply, Water Purification, Sewerage, Sewage Treatment, Refuse Disposal, Industrial Wastes
220 S. State Street, Chicago 4, Ill.

HARZA ENGINEERING COMPANY
Consulting Engineers
Calvin V. Davis — E. Montford Fucik
Richard D. Harza
Hydroelectric Plants and Dams
Transmission Lines
Flood Control, Irrigation
River Basin Development
400 West Madison Street, Chicago 6

SOIL TESTING SERVICES, INC.
Carl A. Metz
John P. Gnaedinger
Foundation Borings
Field and Laboratory Tests of Soils
Analyses and Reports
3529 N. Cicero Ave., Chicago 41, Ill.
1844 N. 35th Street, Milwaukee Wisc.
1105 E. James Street, Portland, Mich.

JENKINS, MERCHANT & NANKIVIL
Consulting Engineers
Municipal Improvements — Sewerage
Power Development — Water Systems
Traffic Surveys — Industrial Plants
Flood Control — Recreational Facilities
Airports — Investigations and Reports
805 East Miller Street
Springfield, Illinois

NED L. ASHTON
Consulting Engineer
Bridges, Swimming Pools, Welded Structures & Foundations, Design & Strengthening.
820 Park Road, — Iowa City, Iowa

STANLEY ENGINEERING COMPANY
Consulting Engineers
Airports — Drainage — Electric Power
Flood Control — Industrial-Rate Studies
Sewerage — Valuation — Waterworks
Hershey Building, Muscatine, Iowa

HAZELET & ERDAL
Consulting Engineers
Bridges — Foundations
Expressways — Dams — Reports
Monadnock Block
Chicago
403 Commerce Bldg., Louisville
Dixie Terminal Bldg., Cincinnati

EUSTIS ENGINEERING COMPANY FOUNDATION AND SOIL MECHANICS INVESTIGATIONS
Soil Borings — *Laboratory Tests*
Foundation Analyses — *Reports*
3635 Airline Highway
New Orleans 20, La.

WHITMAN REQUARDT AND ASSOCIATES
Engineers
Sewerage and Water Systems, Airports, Industrial and Power Plants and Other Structures
Reports — Designs — Specifications — Supervision
1304 St. Paul Street, Baltimore 2, Md.

CRANDALL DRY DOCK ENGINEERS, INC.
Railway Dry Docks, Floating Dry Docks, Basin Dry Docks, Shipyards, Port Facilities
Investigation, Reports, Design Supervision
238 Main St., Cambridge 42, Mass.

IRVING B. CROSBY
Consulting Engineering Geologist
Investigations and Reports
Dams, Reservoirs, Tunnels, Foundations, Groundwater Supplies and Resources
Non-Metallic Minerals
6 Beacon Street
Boston 8, Massachusetts

Enrollment and Subscription Form

(now am)

(A) I (wish to be) enrolled in the_____ Division and receive automatically and WITHOUT CHARGE all of the "Proceedings" Separates issued under the auspices of this Division.

(B) I wish to subscribe to all of the Separates sponsored by the following Divisions:

_____ _____

_____ _____

My account is to be CHARGED AT THE RATE OF $2.00 PER YEAR for each of the subscriptions listed in *(B)*. (Such charges will be included on the 1955 bill for dues.)

My current mailing address is as follows:

_____
(Signature)

_____
(Membership Grade) (Date)

_____
(Street)

_____
(City) (State)

Professional Services

Listed alphabetically by states

DUFFILL ASSOCIATES, INC.
Consulting Engineers
80 Boylston St., Boston 16, Mass.

FAY, SPOFFORD & THORNDIKE
Engineers
John Ayer — Ralph W. Horne
Bion A. Bowman — William L. Hyland
Carroll A. Farwell — Frank L. Lincoln
Howard J. Williams
Airports—Bridges—Turnpikes
Water Supply, Sewerage and Drainage
Port & Terminal Works—Industrial Bldgs.
Boston — New York

JACKSON & MORELAND
Engineers and Consultants
Design and Supervision of Construction
Reports—Examinations—Appraisals
Machine Design—Technical Publications
Boston — New York

METCALF & EDDY
Engineers
Investigations Reports Design
Supervision of Construction
and Operation
Management Valuation Laboratory
Statler Building
Boston 16

BENJAMIN S. SHEINWALD
Architectural Consultants
on
Engineering Projects
Design—Supervision—Reports
85 South Street, Boston 11, Mass.

The Thompson & Lichtner Co., Inc.
Civil and Industrial Engineers
Design, Supervision, Testing,
Engineering and Production Studies.
Special Structures, Tunnels, Airports,
Highways, Foundations.
Office and Laboratory—Brookline, Mass.

BLACK & VEATCH
Consulting Engineers
Water—Sewage—Electricity—Industry.
Reports, Design Supervision of Construction
Investigations, Valuation and Rates
4706 Broadway — Kansas City 2, Mo.

BURNS & McDONNELL
Consulting and Designing Engineers
Kansas City 2, Mo. — Cleveland 14, Ohio
P. O. Box 7088 — 1404 E. 9th St.

GUNITE CONCRETE & CONSTRUCTION COMPANY
Engineers—Cement Gun Specialists—Contractors
Linings, Encasing, Insulating, Repairing,
Fireproofing, Renovating,
New Construction
1301 Woodwether Rd., Kansas City 5, Mo., 2016 West Walnut St., Chicago 12, Ill., 2036 Addison, Houston 25, Texas, St. Louis, Minneapolis, Denver, New Orleans

SVERDRUP & PARCEL, INC.
Consulting Engineers
Bridges Structures and Reports
Industrial and Power Plant
Engineering
Syndicate Trust Bldg., St. Louis 1, Mo.
220 Bush Street, San Francisco 4, Cal.

A. L. ALIN
Consulting Engineer
5927 N. 24 St.
Omaha, Nebraska
Dams, Hydroelectric Power
Flood Control

EDWARDS, KELCEY AND BECK
Consulting Engineers
Survey—Reports—Economic Studies—Transportation, Traffic — Design — Supervision — Management — Port and Harbor Works—Terminals—Expressways — Highways — Grade Separations — Bridges—Tunnels—Water Supply
3 William Street, Newark 2, N. J.
New York — Boston — Philadelphia

PORTER, URQUHART & BEAVIN
O. J. Porter & Co.
Consulting Engineers
Airports—Highways—Dams—Structures
Foundations—Stabilization—Pavements
415 Frelinghuysen Ave., Newark 5, N. J.
76 Ninth Ave., New York 11, N. Y.
2568 West Third St., Los Angeles 5, Calif.
516 Ninth St., Sacramento 14, Calif.

LOCKWOOD, KESSLER & BARTLETT, INC.
Engineers — *Surveyors*
Civil Engineering Investigations, Reports and Designs, Supervision of Construction
Cadastral, Geodetic, Topographic & Engineering Surveys, Photogrammetric Engineering and Mapping
375 Great Neck Rd. Great Neck, N. Y.

B. K. HOUGH
Consulting Engineer
Soils & Foundation Engineering
Site Investigation, Soil Testing, Design Analysis for Earthworks, Foundations and Pavements, Field Inspection, Engineering Reports, Consultation.
121 E. Seneca St. — Ithaca, New York

AMMANN & WHITNEY
Consulting Engineers
Design—Construction Supervision
Bridges, Buildings, Industrial Plants,
Special Structures, Foundations,
Airport Facilities
Expressways
76 Ninth Avenue, New York 11, N. Y.
724 E. Mason Street, Milwaukee 2, Wis.

CLINTON L. BOGERT ASSOCIATES
Consulting Engineers
Clinton L. Bogert — Ivan L. Bogert
Robert A. Lincoln — Donald M. Dimmers
Water and Sewage Works
Refuse Disposal — Industrial Waste
Airports — Flood Control
684 Madison Avenue, New York 22, New York

BOWE, ALBERTSON & ASSOCIATES
Engineers
Water and Sewage Works
Industrial Wastes—Refuse
Disposal—Municipal Projects
Airfields—Industrial Buildings
Reports—Designs—Estimates
Valuations—Laboratory Service
110 William St., New York 38, N. Y.

FRANK L. EHASZ
Consulting Engineers
Structures, Bridges, Airports, Parkways
Design, Supervision of Construction
Investigations, Reports
730 Fifth Avenue, New York 19, N. Y.

FREDERIC R. HARRIS, INC.
Consulting Engineers
Harbors, Piers & Bulkheads, Drydocks, Foundations, Soil Mechanics, Industrial Plants, Water Supply, Flood Control, Airports, Highways, Bridges, Power, Sanitary & Industrial Waste Disposal
27 William Street — New York 5, N. Y.
Fidelity Phila. Trust Bldg., Philadelphia

HAZEN AND SAWYER
Engineers
Richard Hazen — Alfred W. Sawyer
Municipal and Industrial Water Supply, Purification and Distribution, Sewage Works and Waste Disposal, Investigations, Design, Supervision of Construction and Operation.
110 East 42nd St., New York 17, N. Y.

HOWARD, NEEDLES, TAMMEN & BERGENDOFF
Consulting Engineers
Bridges, Structures, Foundations
Express Highways
Administrative Services
1805 Grand Avenue — 55 Liberty Street
Kansas City 6, Mo. — New York 5, N. Y.

KNAPPEN-TIPPETTS-ABBETT McCARTHY
Engineers
Ports, Harbors, Flood Control Irrigation
Power, Dams, Bridges, Tunnels
Highways—Railroads
Subways, Airports, Traffic, Foundations
Water Supply, Sewerage, Reports
Design, Supervision, Consultation
62 West 47th Street, New York City

LEGGETTE & BRASHEARS
Consulting Ground Water Geologists
Water Supply, Salt Water Problems, Dewatering, Recharging, Investigations, Reports.
551 Fifth Avenue, New York 17, N. Y.

MORAN, PROCTOR, MUESER & RUTLEDGE
Consulting Engineers
Foundations for Buildings, Bridges and Dams, Tunnels, Bulkheads, Marine Structures, Soil Studies and Tests, Reports, Design and Supervision.
420 Lexington Ave., New York 17, N. Y.

PARSONS, BRINCKERHOFF HALL & MACDONALD
Engineers
Bridges, Highways, Tunnels, Airports, Traffic and Transportation Reports, Subways, Harbor Works, Dams, Canals, Power Projects, Industrial Buildings, Housing, Sewerage and Water Supply.
51 Broadway — NewYork 6, N. Y.

E. LIONEL PAVLO
Consulting Engineer
Design, Supervision, Reports
Bridges, Highways, Expressways
Marine Structures, Industrial Construction, Public Works, Airports
7 E. 47th St. — New York 17, N. Y.

MALCOLM PIRNIE ENGINEERS
Civil & Sanitary Engineers
Malcolm Pirnie — Ernest W. Whitlock
Robert D. Mitchell — Carl A. Arenander
Malcolm Pirnie, Jr.
Investigations, Reports, Plans
Supervision of Construction
and Operations
Appraisals and Rates
25 W. 43rd Street New York 36, N. Y.

THE PITOMETER ASSOCIATES, INC.
Engineers
Water Waste Surveys
Trunk Main Surveys
Water Distribution Studies
Water Measurement and Special
Hydraulic Investigations
New York, 50 Church St.

ALEXANDER POTTER ASSOCIATES
Consulting Engineers
Water Works, Sewerage, Drainage, Refuse Incinerators, Industrial Wastes, City Planning
50 Church Street, New York 7, N. Y.

SEELYE STEVENSON VALUE & KNECHT
CONSULTING ENGINEERS
Richard E. Dougherty, Consultant
Manufacturing Plants
Heavy Engineering
Structural Mechanical Electrical
101 Park Ave. New York 17, N. Y.

SEVERUD-ELSTAD-KRUEGER
Consulting Engineers
Structural Design—Supervision—Reports
Buildings—Airports—Special Structures
415 Lexington Ave., New York 17, N.Y.

SINGSTAD & BAILLIE
Consulting Engineers
Ole Singstad — David G. Baillie Jr.
Tunnels, Subways, Highways,
Foundations, Parking Garages
Investigations, Reports, Design,
Specifications, Supervision
24 State St. — New York 4, N. Y.

FREDERICK SNARE CORPORATION
Engineers-Contractors
Harbor Works Bridges, Power Plants
Dams, Docks and Foundations
233 Broadway, New York 7, N. Y.
Santiago, Chile — San Juan, P. R.
Havana, Cuba — Lima, Peru
Bogota, Colombia — Caracas, Venezuela

D. B. STEINMAN
Consulting Engineer
BRIDGES
Design, Construction, Investigation, Reports, Strengthening, Advisory Service
117 Liberty Street, New York 6, N. Y.

THE J. G. WHITE ENGINEERING CORPORATION
Design, Construction, Reports, Appraisals
Eighty Broad Street, New York 4, N. Y.

Professional Services

Listed alphabetically by states

JAMES M. CAIRD
Established 1898
C. E. Clifton, H. A. Bennett
Chemist and Bacteriologist
Water Analysis
Tests of Filter Plants
Cannon Building, Troy, N. Y.

CREDLE ENGINEERING COMPANY
Civil Engineers
Structures, Foundations, Soil Borings
Soil Mechanics Investigations, Water & Sewer Systems, Land Surveying
204 E. Markham Av. Durham, N. C.

THE AUSTIN COMPANY
Design — Construction — Reports
Plant Location Surveys — Domestic & Foreign Work
16112 Euclid Avenue, Cleveland, Ohio
New York Detroit Oakland
Chicago Houston Seattle
Los Angeles

HAVENS AND EMERSON
W. L. Havens C. A. Emerson
A. A. Burger F. C. Telles F. W. Jones
H. H. Moseley J. W. Avery
F. S. Palocsay E. S. Ordway
Consulting Engineers
Water, Sewerage, Garbage, Industrial Wastes, Valuations—Laboratories
Leader Bldg. Woolworth Bldg.
Cleveland 14, O. New York 7, N. Y.

The OSBORN ENGINEERING Company
7016 EUCLID AVENUE CLEVELAND 3, OHIO
DESIGNING—CONSULTING
Industrial Plants Office Buildings
Stadiums, Grand Stands, Field Houses
Bridges, Garages, Laboratories
COMPLETE ENGINEERING SERVICES

EDWARD J. SCHAEFER
Consulting Ground-Water Hydrologist
Investigations, Reports, Advice
on
Underground Water-Supply Problems
607 Glenmont Ave., Columbus 14, Ohio
Telephone Ludlow 3316

HENRY R. STAATS
Civil Engineer & Surveyor
Investigations Field Engineering
Surveys Ground Control
Triangulation Preliminary Surveys
Topographical Mapping
2626 S. E. Ankeny Portland, Oregon

CAPITOL ENGINEERING CORPORATION
Engineers-Constructors-Management
DESIGN AND SURVEYS
ROADS AND STREETS
SEWER SYSTEMS WATER WORKS
PLANNING AIRPORTS
BRIDGES TURNPIKES DAMS
Executives Offices
Dillsburg, Pennsylvania
Washington, D. C. Pittsburgh, Pa.
Dallas, Texas Paris, France

GANNETT FLEMING CORDDRY & CARPENTER, INC.
Engineers
Dams, Water Works, Sewage, Industrial Waste and Garbage Disposal—Highways Bridges and Airports, Traffic and Parking —Appraisals, Investigations and Reports.
HARRISBURG, PENNA.
Pittsburgh, Pa. Philadelphia Pa.
Daytona Beach, Fla.

MODJESKI AND MASTERS
Consulting Engineers
F. M. Masters
G. H. Randall J. R. Giese
C. W. Hanson H. J. Engel
Design and Supervision of Construction
Inspection and Reports
Bridges, Structures and Foundations
State St. Bldg. Philadelphia, Pa.
Harrisburg, Pa. New Orleans, La.

ALBRIGHT & FRIEL, INC.
Consulting Engineers
Francis S. Friel
Water, Sewage and Industrial Waste Problems, Airfields, Refuse Incinerators, Dams, Flood Control, Industrial Buildings, City Planning, Reports, Valuations—Laboratory
121 So. Broad Street, Philadelphia 7, Pa.

JUSTIN & COURTNEY
Consulting Engineers
Joel B. Justin Neville C. Courtney
Dams and Power Problems
Hydro Electric Developments
Foundations
121 S. Broad St. Philadelphia 7, Pa.

G. G. GREULICH
Consulting Engineer
Investigations, Reports, Advice.
Pile Foundations, Sheet Piling, Cofferdams, Bulkheads, Piers, Bridge Decks, Bank Vaults. Steel Product Development
609 Gateway Center 140 Stanwix St. Pittsburgh 22, Pa.

HUNTING, LARSEN & DUNNELLS
Engineers
Industrial Plants—Warehouses
Commercial Buildings—Office Buildings
Laboratories—Steel and Reinforced Concrete Design—Supervision
Reports
1150 Century Bldg., Pittsburgh 22, Pa.

MORRIS KNOWLES INC.
Engineers
Water Supply and Purification
Sewerage and Sewage Disposal
Valuations, Laboratory, City Planning
1312 Park Bldg., Pittsburgh 22, Pa.

GILBERT ASSOCIATES, INC.
Engineers • Consultants • Constructors
READING, PA.
Surveys · Design · Supervision
Sanitary Engineering
Industrials and Utilities
Domestic and Foreign
New York . Washington . Philadelphia
Rome . Manila . Medellin

MICHAEL BAKER, JR., INC.
The Baker Engineers
Civil Engineers, Planners, and Surveyors
Airports—Highways—Sewage Disposal Systems—Water Works Design and Operation—City Planning—Municipal Engineering—All Types of Surveys
Home Office: Rochester, Pa.
Branch Office:
Jackson, Miss. Harrisburg, Pa.

C. W. RIVA CO.
Engineers Edgar P. Snow
Highways, Bridges, Tunnels, Airports, Foundations, Sewerage, Water Supply, Reports, Design and Supervision.
511 Westminster St. Prov. 3, R. I.

JACK R. BARNES
Consulting Ground-Water Engineer
Exploration—Evaluation—Development
of
Underground Water Supplies
308 W. 15th St. Tel. 7-3407
Austin, Texas 33-4751

WILLIAM F. GUYTON
Consulting Ground-Water Hydrologist
Underground Water Supplies.
Investigations, Reports, Advice.
307 W. 12th St.
Austin 1, Texas Tel. 7-7165

ENGINEERS TESTING LABORATORY, INC.
Foundation and Soil Mechanics Investigations
Soil Borings Laboratory Tests
Foundation Analyses Reports
3313 Main St. Houston, Texas

GREER & McCLELLAND
Consulting Foundation Engineers
Foundation Investigations — engineering soil testing—undisturbed sampling and core drilling.
2649 N. Main Houston 9, Texas
98 Greenwood Ave., Montclair, N. J.

LOCKWOOD & ANDREWS
Consulting Engineers
Industrial Plants, Harbors, Public Works Roads, Airports Structures, Earthworks Mechanical & Electrical
Reports—Design—Supervision
Surveys—Valuations
Corpus Christi-Houston-Victoria, Texas

PRELOAD ENGINEERS INC.
Founded—1934
Consultants in Prestressed Design
Designers of more than 800 prestressed concrete bridges, buildings, tanks and high pressure pipe lines erected in North America since 1934.
955 North Monroe St., Arlington, Va.

The Engineering Societies Library

can be your library department. To your company a trained staff and a fully equipped library would be a valuable addition. Over 170,000 engineering texts, and files of every worth-while periodical are available for further research to meet your specific needs—patents, design, research, construction, and management problems. Charges cover only the cost of the service, and represent but a fraction of the value you will receive.

The Engineering Societies Library
33 West 39th Street, New York 18, N. Y.
Mr. Ralph H. Phelps, Director

Please send me information pamphlet on services available, and their cost.

Name .....
Street .....
City ..... State .....

USE THIS PROFESSIONAL CARD DIRECTORY

Participation is restricted to consulting engineering firms operated or controlled by members of the

American Society of Civil Engineers

Index to Advertisers

Advertising Manager

James T. Norton

33 West 39th Street — New York 18, N. Y.

Representatives

EASTERN

- ROBERT S. CYPHER
  33 West 39th St., New York 18, N. Y.

MID-WESTERN

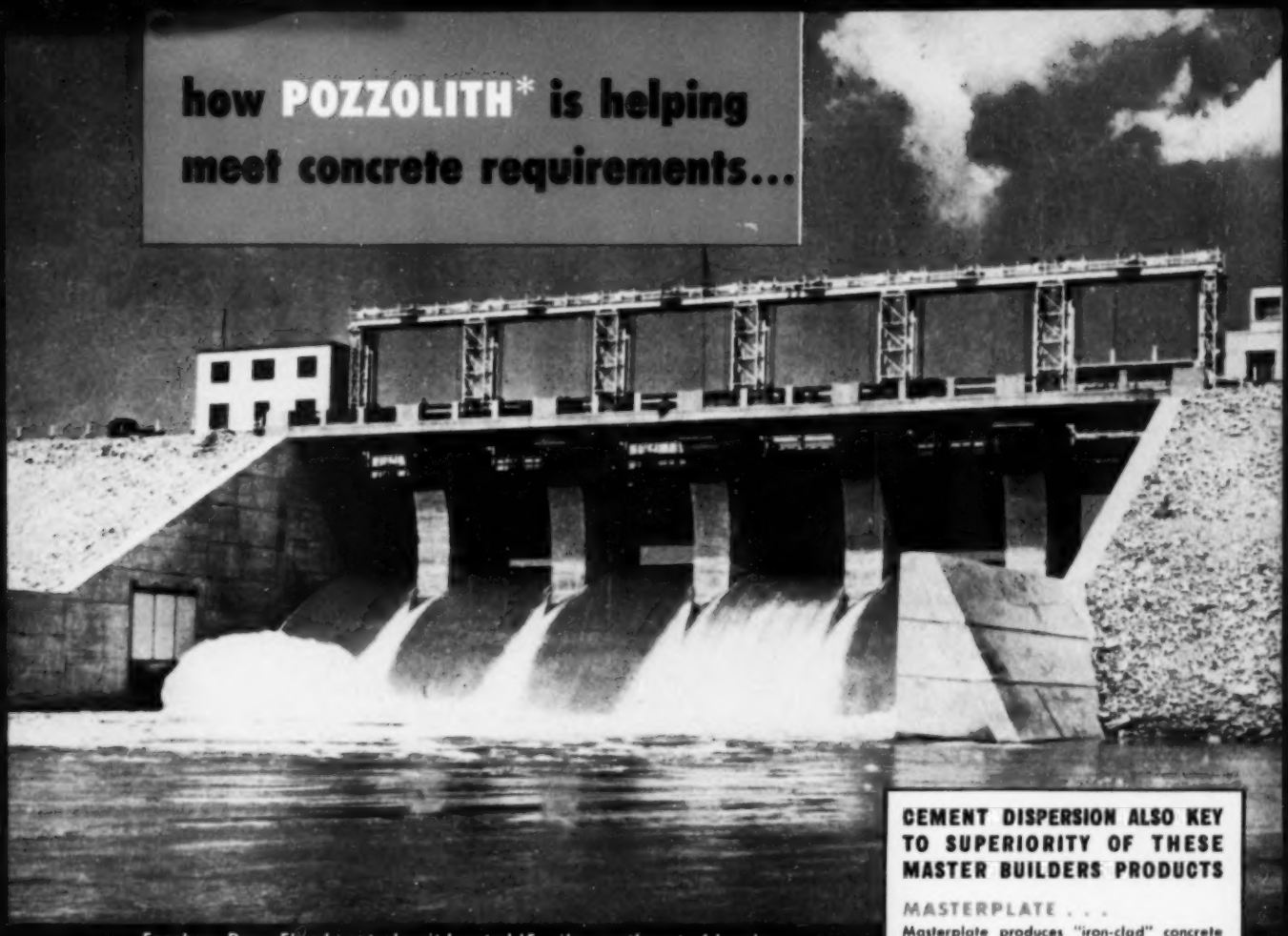
- DWIGHT EARLY AND SONS
  100 North La Salle St., Chicago 2, Ill.

WESTERN

- McDONALD-THOMPSON COMPANY
  625 Market St., San Francisco 5, Calif.

  3727 West Sixth St., Los Angeles 5, Calif.
  National Building,
  1008 Western Ave., Seattle, Wash.
  3217 Montrose Boulevard, Houston 6, Texas
  Colorado National Bank Bldg., Denver 2, Colo.

how POZZOLITH* is helping meet concrete requirements...



Fanshaw Dam. Flood control unit located 15 miles northeast of London, Ontario. Consulting Engineers—H. G. Acres & Company, Niagara Falls; General Contractors—Foundation-Mannix Ltd., Toronto. Concrete supplied by Red-D-Mix Co., Hamiltan, Ontario.

an aid here in producing great durability and abrasion resistance

Pozzolith has proved to be a valuable "tool" in the construction of dams, tunnels, reservoirs, retaining walls, and similar structures because it increases the resistance of concrete to freezing and thawing and lowers permeability. In the Fanshaw Dam Pozzolith also helped meet the important requirement of abrasion resistance.

These are several of the reasons for the wide use of Pozzolith... last year in more than 13,000,000 cubic yards of concrete.

Full information on Pozzolith and "see-for-yourself" demonstration kit sent on request.

*POZZOLITH...the cement-dispersing, water-reducing agent, developed by The Master Builders Co. in 1932, which makes available the optimum amount of air in concrete and fully complies with the water-cement ratio law. Added at the mixer.

CEMENT DISPERSION ALSO KEY TO SUPERIORITY OF THESE MASTER BUILDERS PRODUCTS

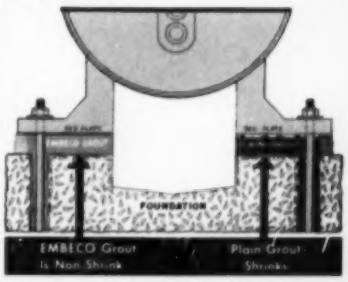
MASTERPLATE . . .

Masterplate produces "iron-clad" concrete floors with 4-6 times longer life; also spark-safe, non-dusting and easy-to-clean. Non-colored and colored. For new floors and resurfacing.

Section of Masterplate Floor. Note Thickness of Armored Surface

EMBECO . . .

Embeco (1) produces flowable, non-shrink, ductile grout which . . . (2) gives full, level, lasting bedplate contact . . . (3) helps avoid costly shutdowns.



the MASTER BUILDERS Co

Subsidiary of American-Marietta Company

CLEVELAND 3, OHIO · TORONTO, ONT. Cable Address, Mastmethod, New York

● Installing a 30" Lock Joint distribution line in a tight spot in the streets of Richmond, Va.

LOCK JOINT

the ideal pressure pipe for distribution systems...

New modern equipment, which permits the easy tapping of concrete pipe, has brought about a great demand for Lock Joint Concrete Pressure Pipe in water distribution systems.

Because of its extremely long life and low maintenance requirements, Lock Joint Pipe is ideally suited for this purpose. Its smooth concrete walls assure permanent high capacity without periodic cleaning, and its conservative design gives maximum safety in congested areas where pipe line failure spells disaster and even minor repairs are difficult and costly.

If your pipe project calls for pressure pipe 16" in diameter or larger, specify Lock Joint, the trouble-free answer to your pressure pipe requirements.

For many years one of the leading producers of sewer, culvert and water supply pipe, Lock Joint also manufactures pressure pipe for:

INDUSTRIAL INSTALLATIONS (Supply, circulating and cooling systems)

SUBAQUEOUS INSTALLATIONS (Water intakes, siphons and sewer outfalls)

WATER WORKS OPERATIONS (Pumping and treatment plant piping)

SEWER WORKS OPERATIONS (Sewer force mains and treatment plant piping)

LOCK JOINT PIPE COMPANY

Established 1905

P. O. Box 269, East Orange, N. J.

PRESSURE PIPE PLANTS: Wharton, N. J., Turner, Kan., Detroit, Mich., Columbia, S. C.

SEWER & CULVERT PIPE PLANTS:

Casper, Wyo. • Cheyenne, Wyo. • Denver, Col. • Kansas City, Mo. • Kennett Square, Pa. Valley Park, Mo. • Chicago, Ill. • Rock Island, Ill. • Wichita, Kan. • Kenilworth, N. J. Hartford, Conn. • North Haven, Conn. • Tucumcari, N. Mex. • Oklahoma City, Okla. • Tulsa, Okla. • Beloit, Wis. • Hato Rey, P. R. • Ponce, P. R. • Caracas, Venezuela • Wholly Owned Subsidiary, Great Lakes Pipe Co., Plants: Buffalo, N. Y. • W. Henrietta, N. Y.